THE
NEW BUSINESS
ARITHMETIC

REVISED EDITION

Ralph Wirn.

THE NEW

Business Arithmetic

A TREATISE ON

Commercial Calculations

REVISED EDITION

J. A. LYONS & COMPANY

NEW YORK   CHICAGO

PREFACE

Since the great majority of those who study Arithmetic need to use it in the transaction of the practical affairs of life, a text-book on the subject should be especially practical. It has been the aim in the preparation of this work to represent the business methods of the times. While a few problems are intended to illustrate some principle, by far the greater number show the application of Arithmetic to the actual business transactions of the day. In this practical character we believe the book will be found unequaled.

The principles of each successive topic are carefully developed by appropriate exercises, so graded that the mind of the student must inevitably grasp the relations of the whole subject, and when the work is completed, comprehend it, not as a mass of loosely-connected details, but as a unified whole.

Since good methods economize time and energy, secure rapidity and accuracy in calculation, and strengthen the reasoning powers, the aim has been to present each subject in the most clear and concise manner, showing the *reason* for every operation performed, in order that the student may learn to rely upon the principle involved and not merely seek for a result.

The treatment of the fundamental rules of Arithmetic has been made simple, and is free from all effort to exalt these rules into complex and difficult propositions. A clear explanation, followed by an abundance of well graded problems, will enable the pupil to readily master the foundation work of Arithmetic.

The work in Fractions is made plain by giving brief, clear and accurate definitions, and simple, concise and logical solutions of concrete problems. Compound Numbers are explained by showing their relation to simple numbers, while the exercises and problems deal with facts found in every-day life.

The subject of Percentage and its applications is made most

thorough and practical.   A system of analysis is employed which must inevitably fix the principles clearly in the mind of the learner.

Equation of Payments, Averaging Accounts and Partnership have been emphasized according to the demand of business.

That the reasoning powers of the pupil may be strengthened and his ability to think independently of pencil and tablet may be increased, several hundred problems for oral solution have been added.   The work undoubtedly now contains an abundance of material, not only for giving facility in computations, but for correct training in arithmetical thought.

We have made an earnest effort to present such a work to teachers and students as will meet with their approval and suit their wants.   We believe by a thorough study of the work young men and women will go out into the business world intelligent persons with ability to apply their knowledge.

THE AUTHOR.

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ARITHMETIC

DEFINITIONS

1. *Arithmetic* is the science of numbers and their use.

2. A *Unit* is a single thing; as, one, one man, one horse.

3. A *Number* is one or more units; as 1, 3, 9, 6 boys.

4. The *Unit of a Number* is one of the kind expressed by the number. The unit of 9 is 1, the unit of 20 feet is 1 foot.

5. An *Integer* is a whole number.

6. *Like Numbers* are those which are composed of the same kinds of units. Thus 25 and 31; 3 yards and 10 yards.

7. An *Abstract Number* is one used without reference to any particular thing or quantity. Thus 15; 64; 280.

8. A *Concrete Number* is one used with reference to some particular thing or quantity. Thus 25 dollars; 14 days; 100 men.

Concrete numbers are called denominate numbers because the denomination or kind is named.

9. A *Sign* is a character used to indicate an operation, or express the qualities or relations of numbers.

A *Solution* is a process of computation used to obtain a required result.

10. A *Problem* is a question for solution.

11. An *Example* is a problem solved, illustrating a principle or rule.

12. A *Principle* is a truth upon which the solution is founded.

13. An *Analysis* is a statement of the successive steps in a solution.

14. An *Explanation* is a statement of the reasons for the manner of solving a problem.

15. A *Rule* is a direction for solving problems.

NOTATION AND NUMERATION

16. *Notation* is the art of writing numbers by means of characters.

17. *Numeration* is the art of reading numbers written by characters.

Two systems of Notation are in general use: the *Roman* and the *Arabic*. The *Roman* is supposed to have been invented by the Romans and employs seven capital letters to express numbers. The *Arabic* is said to be derived from the Arabs and employs ten characters called figures.

ARABIC NOTATION

18. *Figures* are characters used to represent numbers.
There are ten figures:

0,	1,	2,	3,	4,	5,	6,	7,	8,	9.
Zero,	One,	Two,	Three,	Four,	Five,	Six,	Seven,	Eight,	Nine.

The Figure 0, Zero or Cipher, expresses no units, or nothing, when standing alone. The other nine figures express the number of units shown by their names. These figures are called digits.

19. To express numbers greater than nine and less than one hundred, two figures are written side by side; as, thirty-six, 36; seventy-two, 72.

20. To express numbers greater than ninety-nine, three or more figures are written side by side; as, one hundred eighty-five, 185; two thousand six hundred twenty-four, 2624.

21. When figures are written side by side, the one at the right expresses units or ones, the next tens, the next hundreds, the next thousands, etc.

22. The *Simple Value* of a figure is the value it expresses when standing alone, or in unit's place; as 3, 7, 9.

23. The *Local Value* of a figure is the value it expresses when used with other figures to represent a number.

In the number 345, the figure 5 expresses a simple value, and the figures 3 and 4 express local values.

24. The *Order of a Unit* takes its name from the place it occupies. A figure in the first place expresses units of the first order ; in the second place, units of the second order, etc.

When a figure stands in the second place it represents tens ; in the third place hundreds ; in the fourth place thousands, etc.

One ten is written	10
One ten and four, fourteen	14
Two tens, twenty	20
Two tens and seven, twenty-seven	27
Three tens, thirty	30
One hundred, one ten and seven, one hundred seventeen	117
Three hundred, five tens and nine, three hundred fifty-nine	359
Six thousand, five hundreds, nine tens and two, is read, six thousand five hundred ninety-two	6592

NOTE.—In reading whole numbers the word AND should not be used. Thus, seven hundred fifty-four, not seven hundred and fifty-four.

Copy and read the following numbers :

1.	297	*5.*	1790	*9.*	3096
2.	472	*6.*	4607	*10.*	7006
3.	685	*7.*	9218	*11.*	8200
4.	920	*8.*	2030	*12.*	6303

Write the following in figures :

13. One hundred forty-six.

14. Seven hundred ten.

15. Six hundred three.

16. Two hundred ninety.

17. Five hundred thirty-eight.

18 Three thousand seven hundred nineteen.

19. Six thousand nine hundred twenty-seven.

20. Four thousand sixty-four.

21. Seven thousand four hundred one.

22. Five thousand forty.

23. Nine thousand six hundred ninety-six.

24. Eight thousand eight hundred.

25. Seven units of the first order and two of the second.

26. Nine units of the fourth order, three of the third, two of the second and one of the first.

27. Five units of the third order, one of the first.

28. Six units of the fourth order, seven of the second, two of the first.

25. For convenience, figures are arranged in periods of three places each; the first three at the right being called units or one's period; the next three the thousand's period; the next three the million's period, etc.

TABLE

Quadrillions. 6th period.	Trillions. 5th period.	Billions. 4th period.	Millions. 3d period.	Thousands. 2d period.	Units. 1st period.	Periods.
1 4 2,	5 4 6,	8 9 7,	5 3 4,	2 6 1,	9 8 7,	Figures.
18th 17th 16th	15th 14th 13th	12th 11th 10th	9th 8th 7th	6th 5th 4th	3d 2d 1st	Places.
Hundred quadrillions. Ten quadrillions. Quadrillions.	Hundred trillions. Ten trillions. Trillions.	Hundred billions. Ten billions. Billions.	Hundred millions. Ten millions. Millions.	Hundred thousands. Ten thousands. Thousands.	Hundreds. Tens. Units.	

General Principles

1. *Ten units of any order equal one unit of the next higher order...Ten units equal one ten; ten tens equal one hundred; ten hundreds equal one thousand, etc.*

2. *Removing a figure one place to the left increases its value ten times. Removing a figure one place to the right decreases its value ten times.*

To Write Numbers

a. Begin at the left and write the figures belonging to the highest period.

b. Write the hundreds, tens and units of each period in their order, putting a cipher in the place of any order that is omitted.

To Read Numbers

a. Begin at the right and point off the numbers into periods of three figures each.

b. Begin at the left and read each period separately, giving the name to each period except the last.

Read the following:

1.	384	*5.*	136042	*9.*	147002001
2.	9328	*6.*	100420	*10.*	3073640240
3.	11765	*7.*	9793642	*11*	73260479142
4.	29470	*8.*	3106053	*12.*	48600752052

Write the following numbers:

13. Ninety-seven.

14. Three hundred sixty-eight.

15. Two thousand four hundred seventy-five.

16. Thirty-seven thousand one hundred ninety-six.

17. One hundred thirty-six thousand three hundred twenty-seven.

18. Five million three hundred six thousand five hundred three.

ROMAN NOTATION

26. *Roman Notation* employs seven capital letters to express numbers, as follows:

Letters I, V, X, L, C, D, M.

Values 1, 5, 10, 50, 100, 500, 1000.

These letters may be combined to express numbers according to the following principles:

1. Repeating a letter repeats its value.

Thus, II represents 2; XX, 20; CCCC, 400; DD, 1000.

2. When a letter is placed after one of greater value, its value is to be added to that of the greater.

Thus, VI represents 6; XV, 15; XXI, 21; DC, 600; DCX, 610.

3. When a letter is placed before one of greater value, its value is to be taken from the greater.

Thus, IX represents 9; XL, 40; XC, 90; CD, 400.

4.   When a letter of any value is placed between two letters, each of greater value, its value is taken from the sum of the other two.

Thus, XIV represents 14 ; XIX, 19 ; LIX, 59 ; CXL, 140.

5.   A bar placed over a letter increases its value one thousand times.

Thus, $\overline{X}$ represents 10000 ; $\overline{XL}$, 40000 ; $\overline{CD}$, 400000.

27.   TABLE OF ROMAN NOTATION

Roman	Arabic.	Roman.	Arabic.	Roman.	Arabic.	Roman.	Arabic.
I,	1.	IX,	9.	XX,	20.	XC,	90.
II,	2.	X,	10.	XXI,	21.	C,	100.
III,	3.	XIII,	13.	XXX,	30.	CCC,	300.
IV,	4.	XIV,	14.	XL,	40.	D,	500.
V,	5.	XV,	15.	L,	50.	DCC,	700.
VI,	6.	XVIII,	18.	LX,	60.	M,	1000.
VIII,	8.	XIX,	19.	LXXX,	80.	MD,	1500.

28. Express by Roman notation :

1. Eighteen.
2. Twenty-three.
3. Fifty-eight.
4. Ninety-nine.
5. Eighty-four.

6. One hundred eighty-eight.
7. One hundred ninety-nine.
8. Five hundred seventeen.
9. Six hundred forty-five.
10. Seven hundred sixty-one.

11.   428.
12.   975.
13.   1116.
14.   23480.
15.   76103.

29. Express by Arabic notation :

1. XXIX.
2. LXVIII.
3. CLXIV.
4. CXXIV.
5. CCCXXXIII.

6. DCLVI.
7. MDLVIII.
8. $\overline{C}$LII.
9. $\overline{V}$DXXII.
10. $\overline{DX}$.

11. CXIX.
12. X$\overline{I}$CCIV.
13. $\overline{MM}$DCXVIII.
14. $\overline{V}$DXLIV.
15. MDLXXII.

ADDITION

30. *Addition* is uniting two or more numbers into one number.

31. The *Sum* or *Amount* is the number obtained by adding.

32. The *Sign* of addition is an upright cross $+$, and is read *plus*. When it is placed between two numbers, it shows that they are to be added. $\$3 + \$2$ is read 3 dollars plus 2 dollars, and means that 2 dollars are to be added to 3 dollars.

The sign $ is used for dollars, c. or cts. for cents.

33. The *Sign* of equality is two horizontal lines $=$, and is read *equal* or *are equal to*. $2 + 5 = 7$ is read 2 plus 5 equal 7.

34. *When the amount of each column is less than ten.*

1. A farmer raised 232 bushels of corn, 142 bushels of wheat and 223 bushels of oats; how many bushels did he raise in all?

Find the sum of each of the following:

1	*2*	*3*	*4*	*5*	*6*
232	323	245	312	437	1102
142	242	321	243	140	1312
223	324	132	412	321	4132
——	——	——	——	——	——
597					

7. What is the sum of 321, 142 and 323?

8. What is the amount of 213, 152 and 401?

9. What is the sum of 3232, 2323 and 4102?

10. I paid $212 for a wagon, $150 for one horse, $210 for another horse, and $11 for a set of harness. What did I pay for all?

35. *When the sum of any column is greater than 9.*

1. Find the sum of 3164, 2247, 4234 and 3232.

SOLUTION
3164
2247
4234
3232

12877

EXPLANATION.—The sum of the units 2, 4, 7 and 4 is 17 units or 1 ten and 7 units; write the 7 units under the column of units and add 1 ten to the column of tens. The sum of the tens 1, 3, 3, 4 and 6 is 17 tens or 1 hundred and 7 tens; write the tens under the column of tens and add the 1 hundred to the column of hundreds. The sum of the hundreds 1, 2, 2, 2 and 1 is 8 hundreds; write under the column of hundreds. The sum of the thousands 3, 4, 2 and 3 is 12 thousands or 1 ten-thousand and 2 thousands; write the 2 thousands under the column of thousands and the 1 ten-thousand in the place of ten-thousands. The result 12877 is the sum required.

1. Units of the same order are written in the same column; and when the sum in any column is 10 or more than 10, it produces *one or more units* of a higher order, which must be added to the next column. This process is sometimes called "carrying the tens."

2. In adding, learn to pronounce the partial results without naming the numbers separately; thus instead of saying 2 and 4 are 6 and 7 are 13, simply pronounce the results 6, 13, 17, etc.

From the foregoing examples and illustrations we deduce the following:

To Add Whole Numbers

a. Write the numbers so that figures of the same order are in the same column.

b. Begin at the right and add each column separately.

c. When the sum of any column is greater than 9, place the right-hand figure of the result under the column added and add the remaining figure or figures to the next column.

d. Write at the left the sum of the last column.

PROBLEMS

(2)	(3)	(4)	(5)	(6)	(7)
24	265	432	1362	3420	9416
32	314	864	1487	1862	3624
46	286	526	4532	1425	1583
84	627	893	2386	6347	2436

(8)	(9)	(10)	(11)	(12)	(13)
234	979	9140	94187	71758	986756
562	2864	6968	71849	3680	863694
846	52	8947	48197	797	387623
324	715	7968	89471	36425	890124
118	3680	5392	19478	943628	1369479
462	9289	18364	26480	102154	279562
367	360	27147	62849	864209	8325791
214	14006	38297	56783	579135	2345678

14. 128 + 324 + 116 + 893 + 246 + 427 = how many?

15. 1265 + 3482 + 2149 + 3625 + 1304 + 107 = how many?

16. 28603 + 24567 + 39042 + 16841 + 40218 = how many?

17. Find the sum of $347, $962, $375, $842 and $636.

18. What will be the amount of $3476, $1924, $4822, $3965 and $7180?

19. Add 8765 feet, 5678 feet, 6758 feet, 7685 feet and 3629 feet.

20. Add forty-nine, seventy-six, three hundred twenty-five, nine thousand six hundred thirty-three, five thousand one hundred ten and sixty-two thousand four hundred eleven.

21. Find the sum of three hundred seventy, two thousand eighty-one, seven thousand four hundred sixteen, fifty thousand one hundred twenty-nine and four hundred forty-four thousand six hundred ninety-three.

22. A paid $762 for hogs, $1869 for cattle, $3796 for horses and then had $9240 remaining. How much had he at first?

23. I sold six cows that weighed as follows: 1824 pounds, 1369 pounds, 964 pounds, 2217 pounds, 1746 pounds, 1940 pounds. How many pounds did they all weigh?

24. A farmer bought four farms. He paid $3221 for the first, $5680 for the second, $4216 for the third and $2645 for the fourth. How much did he pay for all?

25. I paid $212 for a wagon, $154 for one horse, $210 for another horse and $65 for a set of harness. What did I pay for all?

26. R. D. Lyman bought four lots. He paid $2232 for the first, $3124 for the second, $1485 for the third and $2238 for the fourth. Find the cost of the four lots.

27. A merchant paid $746 for calico. $294 for linen, $2864 for shoes, $212 for toys and $1169 for carpets. How much did he pay for all?

28. A farmer raised 1278 bushels of corn, 1642 bushels of wheat, 765 bushels of oats, 367 bushels of rye, 93 bushels of barley and 160 bushels of buckwheat. Find the number of bushels of grain he raised.

$$
\begin{array}{cccccc}
(29) & (30) & (31) & (32) & (33) & (34) \\
476 + & 908 + & 126 + & 443 + & 180 + & 1265 = x \\
390 + & 371 + & 324 + & 298 + & 976 + & 3428 = x \\
915 + & 569 + & 503 + & 876 + & 209 + & 1456 = x \\
207 + & 245 + & 891 + & 569 + & 314 + & 9234 = x \\
841 + & 703 + & 736 + & 137 + & 563 + & 1867 = x \\
632 + & 421 + & 517 + & 910 + & 842 + & 2854 = x \\
234 + & 127 + & 143 + & 347 + & 175 + & 3629 = x \\
143 + & 354 + & 274 + & 256 + & 224 + & 2872 = x \\
536 + & 781 + & 531 + & 324 + & 135 + & 3428 = x \\
245 + & 436 + & 275 + & 463 + & 253 + & 9234 = x \\
\hline
x + & x + & x + & x + & x + & x = x
\end{array}
$$

35. The proprietors of a college paid $2675 for rent, $6286 for teachers, $824 for school furniture, $269 for lights and $970 for fuel. Find the total expense.

36. A bankrupt firm's resources are cash $740, dry-goods $1965, boots and shoes $1647. Brown's note $1278, office furniture $280 and real estate $2394. Find the total resources of the firm.

37. I bought four horses for $85 each. I sold the first for $12 more than cost, the second for $16 more than cost, the third for $26 more than cost and the fourth for $41 more than cost. How much money did I receive for all?

38. A, B, C and D form a partnership. A invests $2640, B invests $3160, C invests $1125 more than A and B together, and D invests as much as A and C together. How much did they all invest in the business?

39. A stock dealer bought 218 sheep for $568, 319 hogs for
$1162, 123 calves for $2316, 24 oxen for $695 and 11 horses for
$957. How many head of stock did he buy and how much did
they cost?

40. I sold a house for $3278 and a lot for $1360. I lost $392
on the house and $125 on the lot. What did both cost me?

41. Find the sum of $618, $974, $1243, $7896, $20374,
$36345, $9289, $33696, $180, $49270 and $37025.

(42)	(43)	(44)	(45)	(46)
$852 +$	$895 +$	$967 +$	$58378 +$	$47114 = x$
$734 +$	$766 +$	$3833 +$	$64956 +$	$89725 = x$
$3383 +$	$677 +$	$592 +$	$7895 +$	$65836 = x$
$7930 +$	$2814 +$	$5745 +$	$6384 +$	$85684 = x$
$496 +$	$5920 +$	$824 +$	$5463 +$	$78912 = x$
$757 +$	$6782 +$	$978 +$	$981 +$	$97865 = x$
$2183 +$	$588 +$	$684 +$	$4752 +$	$65438 = x$
$3652 +$	$676 +$	$756 +$	$3946 +$	$99914 = x$
$1138 +$	$983 +$	$1492 +$	$895 +$	$88827 = x$
$2795 +$	$1495 +$	$767 +$	$1574 +$	$77715 = x$
$676 +$	$674 +$	$4543 +$	$6388 +$	$66624 = x$
$764 +$	$542 +$	$786 +$	$5946 +$	$55568 = x$
$842 +$	$721 +$	$692 +$	$7892 +$	$89735 = x$
$13798 +$	$2987 +$	$370 +$	$1147 +$	$97814 = x$

$$x \;+\; x \;+\; x \;+\; x \;+\; x \;=\; x$$

(47)	(48)	(49)	(50)	(51)
790	9999	49	123456	213579
965	8989	428	789012	486420
1208	7897	3695	654321	397531
9669	36925	16378	210987	124683
375	52963	875692	913579	610793
92648	13579	3346279	806421	239701
30245	97531	963015	793519	896543
89762	496894	97892	421608	528647
24689	345678	496835	988997	134569
765432	876543	9469358	657893	174682
234567	6543210	642086	798979	212345
98898	9876543	59371	397856	167890

SUBTRACTION

36. *Subtraction* is taking one number from another.

37. The *Minuend* is the number from which we subtract.

38. The *Subtrahend* is the number to be taken from the minuend.

39. The *Remainder* or *Difference* is the number left or remaining after subtracting.

40. The *Sign* of subtraction is a short horizontal line —, and is called *minus;* when placed between two numbers it shows that the second is to be subtracted from the first. 6 — 2 is read 6 minus 2, and means that 2 is to be subtracted from 6.

The minuend and subtrahend must be *like numbers;* thus, 5 dollars from 9 dollars leave 4 dollars; 5 apples from 9 apples leave 4 apples; but it would be absurd to say 5 apples from 9 dollars, or 5 dollars from 9 apples.

41. *When each figure in the minuend is greater than its corresponding figure in the subtrahend.*

1. From 958 subtract 324.

	SOLUTION
MINUEND	958
SUBTRAHEND	324
DIFFERENCE OR REMAINDER	634

Find the difference or remainder in each of the following:

(2)	(3)	(4)	(5)	(6)	(7)
67	98	86	876	676	925
35	26	31	334	415	213

8. Bought a house for $547 and sold it for $315. What was my loss?

9. Bought a farm for $620 and sold it for $855. What was my gain?

10. A and B together bought real estate for $6985. A paid $4130. How much did B pay?

11. A farmer had 4687 bushels of wheat and sold 2380 bushels. How many bushels remained?

12. A man having 96489 bricks, sold 34375 of them. How many had he left?

13. In a factory 86955 yards of cloth were made in one week, of which 36520 yards were sold. How many yards remained?

42. *When the figures in the minuend are not all greater than the corresponding figures in the subtrahend.*

1. From 834 take 378.

SOLUTION   EXPLANATION.—Since 8 units cannot be subtracted from
834   4 units, add 1 ten of 3 tens to units, thus leaving 2 tens
378   and giving 14 units; 8 units from 14 units leaves 6 units.
———   Since 7 tens cannot be subtracted from 2 tens, add 1 hun-
456   dred of the 8 hundreds, thus leaving 7 hundreds and giving
     12 tens; 7 tens from 12 tens leave 5 tens, 3 hundreds from

7 hundreds leaves 4 hundreds. The result, 456, is the difference required.

From the preceding illustrations we have the following:

To Subtract Whole Numbers

a. Write the subtrahend under the minuend so that figures of like order are in the same column.

b. Begin at the right and subtract each column separately.

c. If the lower figure is greater than the upper, add ten to the upper figure and subtract the lower from it. Take one from next upper figure and proceed as before.

NOTES.—1. The sum of the remainder and subtrahend equals the minuend.
       2. The difference between the minuend and remainder equals the subtrahend.

PROBLEMS

(2)	(3)	(4)	(5)	(6)	(7)
873	6423	1969	8146	3176	9076
538	3862	1408	4377	2907	4567

(8)	(9)	(10)	(11)	(12)
5097	76377	67777	900076	767340
3809	45761	46699	899934	5039

13. From 962 take 824.

14. 6593 — 1807 = how many?

15. 80014 — 43190 = how many?

16. From 35467 take 12479.

17. From 94100 take 5007.

18. Take 307709 from 604562.

19. Take 42620 from 58364.

20. Subtract ten thousand six hundred forty-two from fifteen thousand fifteen.

21. From one million nine thousand six take twenty thousand four hundred.

22. What is the difference between two million seven thousand eighteen, and one hundred five thousand seventeen?

23. A man receiving a salary of $2450, spent for family expenses $968. How much had he left?

24. A farm that cost $6200 was sold at a loss of $743. For how much was it sold?

25. B has $8000 and owes $3749. How much will he have after paying what he owes?

26. Bought land for $9000, sold half for $6175 and the remainder for $7140. What did I gain on the land?

27. A man having $10000 lost $140. How much had he left?

28. A builder agreed to build a church for $31840; it cost him $27196. What was his gain?

29. A man commenced business with $3760, and at the end of two years had $6708. How much did he gain?

29. A merchant bought goods of a manufacturer amounting to $3180 and paid him cash amounting to $1892. How much does he still owe the manufacturer?

31. The distance from New York to Queenstown is 2890 miles. After having sailed 1640 from New York, how far is a vessel from Queenstown?

32. A bought a lot and built a house upon it. The lot cost him $1625. He paid for carpenter work on the house $2340; for mason work $428; for plastering $534; for plumbing $246; for painting $186, and for fencing, grading, etc., $125. He then sold both house and lot for $6800. What was his gain?

33. Find the balance of the following accounts:

Dr.					MILLER & MILLER				Cr.
1905						1905			
Jan.	1	Balance,	$125.60		Jan.	5	Cash,		$125.60
Jan.	4	Mdse., 30 da.,	246.24		Jan.	9	Sight Draft,		325.00
Jan.	6	Mdse., 2/10,	563.42		Jan.	12	Ret'd Goods,		25.94
Jan.	9	Mdse., 10 da.,	327.64		Jan.	26	Note, 30 da.		400.00
Jan.	24	Mdse., 30 da.,	297.29						

34.

Dr.				BROWNING, KING & CO.				Cr.
1905				1905				
Feb.	10		$300.00	Feb.	1	Balance		$327.65
Feb.	15		100.00	Feb.	4			124.00
Feb.	18		31.65	Feb.	6			75.26
Feb.	26		126.34	Feb.	12			24.37
				Feb.	20			62.43
				Feb.	22			126.34
				Feb.	24			316.24

35.

DEPOSITORS' LEDGER, BANKERS' NATIONAL BANK

	Accounts	Balance	Deposit	Checks in Detail	Total Checks	Balance
1.	Adams, Wm.	$ 324.36	$1000.00	$ 25.00 136.00 624.37 324.00	$785.37	$538.99
2.	Allison, W. K.	462.85	1114.60	476.21	***.**	***.**
3.	Brown, F. C.	1142.61	3125.00	1000.00 724.36	?	?
4.	Dennis & Co., W. E.	25.60	784.00	41.25 63.00	?	?
5.	Fern Bros. & Co.	284.36	936.24	216.40 317.42	?	?
6.	Henry & Henry	924.65	824.35	400.00 75.63	?	?
7.	Lamson & Bro.	2346.80	2143.64	369.80 421.00	?	?
8.	Mann & Smith	9175.20	924.81	725.14	725.14	?
9.	Nero Mfg. Co.	1146.24	475.60	362.24 436.43	?	?
19.	Mano Eng. Co.	3174.38	976.97	824.36 642.63	?	?
		*****.**	*****.**	?	?	?
	Proof	Bal.	+ Dep.	—	Total Checks	= Bal.

MULTIPLICATION

43. *Multiplication* is taking one number as many times as there are units in another. It is a short method of adding equal numbers; thus, 2 cents + 2 cents + 2 cents + 2 cents = 4 × 2 cents = 8 cents.

44. The *Multiplicand* is the number to be taken; as, 2 cents in the above.

45. The *Multiplier* is the number which shows how many times the multiplicand is taken; as, 4 in the above.

46. The *Product* is the number obtained by multiplying; as, 8 cents in the above.

47. The *Sign* of multiplication is an oblique cross ×, and is read *times* when the multiplier is placed first, and *multiplied by* when the multiplicand is first. When placed between two numbers it shows that one is to be multiplied by the other. 4 × 2 cents is read 4 times 2 cents and means that 2 cents are taken 4 times in addition, or that 2 cents are multiplied by 4.

The multiplicand and multiplier are called *factors,* as they both together produce the product. The multiplicand may be either an abstract or a concrete number. The multiplier must always be an abstract number. The product is an abstract or concrete number according as the multiplicand is abstract or concrete.

Multiplication is a short method of performing addition when the numbers to be added are equal.

MULTIPLICATION TABLE

$1 \times 1 = 1$	$2 \times 1 = 2$	$3 \times 1 = 3$	$4 \times 1 = 4$
$1 \times 2 = 2$	$2 \times 2 = 4$	$3 \times 2 = 6$	$4 \times 2 = 8$
$1 \times 3 = 3$	$2 \times 3 = 6$	$3 \times 3 = 9$	$4 \times 3 = 12$
$1 \times 4 = 4$	$2 \times 4 = 8$	$3 \times 4 = 12$	$4 \times 4 = 16$
$1 \times 5 = 5$	$2 \times 5 = 10$	$3 \times 5 = 15$	$4 \times 5 = 20$
$1 \times 6 = 6$	$2 \times 6 = 12$	$3 \times 6 = 18$	$4 \times 6 = 24$
$1 \times 7 = 7$	$2 \times 7 = 14$	$3 \times 7 = 21$	$4 \times 7 = 28$
$1 \times 8 = 8$	$2 \times 8 = 16$	$3 \times 8 = 24$	$4 \times 8 = 32$
$1 \times 9 = 9$	$2 \times 9 = 18$	$3 \times 9 = 27$	$4 \times 9 = 36$
$1 \times 10 = 10$	$2 \times 10 = 20$	$3 \times 10 = 30$	$4 \times 10 = 40$
$1 \times 11 = 11$	$2 \times 11 = 22$	$3 \times 11 = 33$	$4 \times 11 = 44$
$1 \times 12 = 12$	$2 \times 12 = 24$	$3 \times 12 = 36$	$4 \times 12 = 48$

$5 \times 1 = 5$	$6 \times 1 = 6$	$7 \times 1 = 7$	$8 \times 1 = 8$
$5 \times 2 = 10$	$6 \times 2 = 12$	$7 \times 2 = 14$	$8 \times 2 = 16$
$5 \times 3 = 15$	$6 \times 3 = 18$	$7 \times 3 = 21$	$8 \times 3 = 24$
$5 \times 4 = 20$	$6 \times 4 = 24$	$7 \times 4 = 28$	$8 \times 4 = 32$
$5 \times 5 = 25$	$6 \times 5 = 30$	$7 \times 5 = 35$	$8 \times 5 = 40$
$5 \times 6 = 30$	$6 \times 6 = 36$	$7 \times 6 = 42$	$8 \times 6 = 48$
$5 \times 7 = 35$	$6 \times 7 = 42$	$7 \times 7 = 49$	$8 \times 7 = 56$
$5 \times 8 = 40$	$6 \times 8 = 48$	$7 \times 8 = 56$	$8 \times 8 = 64$
$5 \times 9 = 45$	$6 \times 9 = 54$	$7 \times 9 = 63$	$8 \times 9 = 72$
$5 \times 10 = 50$	$6 \times 10 = 60$	$7 \times 10 = 70$	$8 \times 10 = 80$
$5 \times 11 = 55$	$6 \times 11 = 66$	$7 \times 11 = 77$	$8 \times 11 = 88$
$5 \times 12 = 60$	$6 \times 12 = 72$	$7 \times 12 = 84$	$8 \times 12 = 96$

$9 \times 1 = 9$	$10 \times 1 = 10$	$11 \times 1 = 11$	$12 \times 1 = 12$
$9 \times 2 = 18$	$10 \times 2 = 20$	$11 \times 2 = 22$	$12 \times 2 = 24$
$9 \times 3 = 27$	$10 \times 3 = 30$	$11 \times 3 = 33$	$12 \times 3 = 36$
$9 \times 4 = 36$	$10 \times 4 = 40$	$11 \times 4 = 44$	$12 \times 4 = 48$
$9 \times 5 = 45$	$10 \times 5 = 50$	$11 \times 5 = 55$	$12 \times 5 = 60$
$9 \times 6 = 54$	$10 \times 6 = 60$	$11 \times 6 = 66$	$12 \times 6 = 72$
$9 \times 7 = 63$	$10 \times 7 = 70$	$11 \times 7 = 77$	$12 \times 7 = 84$
$9 \times 8 = 72$	$10 \times 8 = 80$	$11 \times 8 = 88$	$12 \times 8 = 96$
$9 \times 9 = 81$	$10 \times 9 = 90$	$11 \times 9 = 99$	$12 \times 9 = 108$
$9 \times 10 = 90$	$10 \times 10 = 100$	$11 \times 10 = 110$	$12 \times 10 = 120$
$9 \times 11 = 99$	$10 \times 11 = 110$	$11 \times 11 = 121$	$12 \times 11 = 132$
$9 \times 12 = 108$	$10 \times 12 = 120$	$11 \times 12 = 132$	$12 \times 12 = 144$

48. *When the multiplier consists of one figure.*

1. Multiply 436 by 4.

EXPLANATION.—4 times 6 units are 24 units, or 2 tens and 4 units; write the 4 units in units' place, and add the 2 tens to the product of tens. 4 times 3 tens are 12 tens, plus the 2 tens (from the product of units) are 14 tens, or 1 hundred and 4 tens; write the 4 tens in tens' place and add the 1 hundred to the product of hundreds. 4 times 4 hundreds are 16 hundreds, plus the 1 one hundred are 17 hundreds, or 1 thousand and 7 hundreds; write the 7 hundred in hundreds' place, and the 1 thousand in thousands' place. The result, 1744, is the product required.

	SOLUTION
MULTIPLICAND	436
MULTIPLIER	4
PRODUCT	1744

Find the product of each of the following:

(2)	(3)	(4)	(5)	(6)	(7)
1624	2436	1837	3262	8425	2987
2	3	4	5	6	7

(8)	(9)	(10)	(11)	(12)	(13)
3204	4624	3285	4623	8423	6327
8	9	4	6	5	7

14. Multiply 12687 by 2.　　*18.* Multiply 32346 by 6.

15. Multiply 43745 by 3.　　*19.* Multiply 49728 by 7.

16. Multiply 81968 by 4.　　*20.* Multiply 27856 by 8.

17. Multiply 32643 by 5.　　*21.* Multiply 38769 by 9.

22. In 1 gallon there are 4 quarts. How many quarts are there in 2647 gallons?

23. A man receives $2645 a year. How much does he receive in 5 years?

24. What will it cost to dig a ditch 7 miles long at $273 per mile?

25. What will 8 acres of land cost at $259 per acre?

26. When flour is selling at $9 per barrel, what will 3642 barrels cost?

27. If a man walks 6 miles an hour, how many miles will he walk in 16 days by traveling 8 hours each day?

28. If a bank clears $37293 each year, how much will it clear in 7 years?

49. *When the multiplier is expressed by more than one figure.*

1. Multiply 436 by 243.

SOLUTION

MULTIPLICAND　436
MULTIPLIER　243

PARTIAL
PRODUCTS { 1308
1744
872

PRODUCT　105948

EXPLANATION.—The product of 436 by 3 units is 1308 units; write so the right-hand figure is in units' place. The product 436 by 4 tens is 1744 tens; write so the right-hand figure is in tens' place. The product of 436 by 2 hundreds is 872 hundreds; write so the right-hand figure is in hundreds' place. Add the partial products. This gives 105948, the product required.

1. When the multiplier contains two or more figures, the several results obtained by multiplying by each figure are called *partial* products.

2. When there are ciphers between the significant figures of the multiplier, pass over them, and multiply by the significant figures only.

From the preceding examples and illustrations we deduce the following:

To Multiply Whole Numbers

a. When the multiplier contains two or more figures, write it under the multiplicand so that figures of the same order are in the same column.

b. Begin at the right and multiply the multiplicand by each figure of the multiplier, and write the first figure of each product under the figure of the multiplier that produced it.

c. Add the partial products.

Notes.—1. When there are ciphers at the right of the multiplier or multiplicand, place the right-hand figure of the multiplier under the right-hand figure of the multiplicand and multiply as if there were no ciphers.

2. After multiplying annex to the product as many ciphers as there are at the right of both the multiplier and multiplicand.

PROBLEMS

	(2)	(3)	(4)	(5)	(6)	(7)
Multiply	365	463	268	796	397	1584
by	47	36	52	68	286	674

8. Multiply 368 by 43.   *12.* Multiply 8765 by 574.

9. Multiply 4096 by 246.   *13.* Multiply 3700 by 1420.

10. Multiply 1628 by 250.   *14.* Multiply 12000 by 900.

11. Multiply 2374 by 2300.   *15.* Multiply 7324 by 2364.

16. At $436 per acre, what will 394 acres cost?

17. Find the cost of 368 hogsheads of tobacco at $567 per hogshead.

18. A drover bought 763 head of oxen at an average of $67 per head. What did they cost him?

19. How many feet are there in 150 miles, if there are 5280 feet in 1 mile?

20. In 1 pound there are 7000 grains. How many grains are there in 1260 pounds?

21. A factory employs 236 men at an average of $147 per month. What amount do they all receive?

22. A manufacturer sold 328 self-binding reapers at $469 each. How much did he receive for them?

23. If 1 barrel of flour weighs 200 pounds, what will 760 barrels weigh?

24. What will 894 bushels of wheat weigh if 1 bushel weighs 60 pounds?

25. A farmer bought 207 acres of land at $80 per acre. What was the cost?

26. In 1 hogshead there are 63 gallons. How many gallons are there in 3267 hogsheads?

27. How many cubic inches are there in 2362 gallons, if 1 gallon contains 231 cubic inches?

28. If in 1 bushel of apples there are 56 pounds, how many pounds are there in 942 bushels?

29. Find the cost of 2450 bushels of wheat at 85 cents per bushel.

30. If a man takes 30300 steps each day for 260 days, how many steps does he take?

31. If a boy writes 1605 words an hour, how many words will he write in 40 days by working 12 hours each day?

32. A man bought 420 loads of corn, 36 bushels in each load. How many pounds did he buy if each bushel weighs 56 pounds?

33. I sold 18 carloads of hogs, 35 hogs in each car, at 10 cents per pound. The hogs averaged 320 pounds. How much did I receive for the whole lot?

SPECIAL CASES IN MULTIPLICATION

a. To multiply by 10, 100 or 1 with any number of ciphers following.

b. To multiply when the multiplier has ciphers at the right.

c. To multiply when there are ciphers at the right of each term.

d. To multiply when the unit figure of the multiplier is one.

e. To multiply when the left-hand figure of the multiplier is one.

f. To multiply by 11, 22, etc.

g. Cross multiplication.

Illustration

a. $32 \times 100 = 32$ and the addition of two ciphers, or 3200.
EXAMPLES.—49×100; 53×10; 645×10; 327×100.
b. $24 \times 90 = 9 \times 24$ and the addition of one cipher, or 2160.
EXAMPLES.—25×80; 84×600; 36×200; 71×800.
c. $90 \times 80 = 9 \times 8$ and the addition of two ciphers, or 7200.
EXAMPLES.—240×30; 3600×900; 2500×2500; $90 \times$ 910.

d. $243 \times 21 = $ 243×21
                          $\underline{486}$
                          5103

EXAMPLES.—294×31; 846×51; 327×601; 426×701.
e. $374 \times 16 = $ 374×16
                          $\underline{2244}$
                          5984

EXAMPLES.—427×17; 375×104; 724×19; 562×109.
f. $3452 \times 11 = 37972$.

Write 2 as the first figure, $(5 + 2)$ as the second, $(5 + 4)$ as the third, $(3 + 4)$ as the fourth and 3 as the fifth. Carry when necessary.

To multiply by 33, multiply each addition by 3, then add the carrying number.

EXAMPLES.—3463×11; 4234×22; 3714×33; 4637×55; 9876×11; 7964×66.

g. $64 \times 76 = 4864$.

(6×4) = units. Write the 4 and carry the 2. $2 + (6 \times 6) + (4 \times 7) = $ tens' place. Write the 6 and carry the $6 + (6 \times 7) = $ hundreds' place; 4864 the desired result.

EXAMPLES.—

1. $24 \times 36 = x$ 2. $94 \times 63 = x$
   $62 \times 47 = x$ $38 \times 45 = x$
   $74 \times 39 = \underline{x}$ $57 \times 67 = \underline{x}$
   x x

PROBLEMS IN ADDITION, SUBTRACTION AND MULTIPLICATION

50. *1*. Bought 230 bushels of corn at 40 cents a bushel and 365 bushels of wheat at 80 cents a bushel. What did both cost?

2. A teacher receives a salary of $1300 a year and pays $360 for board, $200 for clothing, $100 for books and $45 for other expenses. What does he save in the year?

3. A merchant bought 288 barrels of flour for $1960 and sold it at $8 a barrel. How much did he gain?

4. A farmer bought 34 head of cattle at $18 a head and sold them at $21 a head. How much did he gain by the operation?

5. A lawyer has an income of $4325 a year, and his daily expenses are $4. What will he save in a year of 365 days?

6. A sold a farm of 360 acres at $45 an acre; B sold one of 280 acres at $60 an acre. Which received the greater sum, and how much?

7. A farmer sold 263 bushels of wheat at $1 a bushel. He received in payment 23 yards of cloth at $4 a yard, and the balance in groceries. What did the groceries cost him?

8. I sold 17 cows at $36 apiece and for them received 65 tons of hay at $9 a ton and the remainder in money. How much money did I receive?

9. A man bought a house for $2867. He expended in repairing it $16 for plumbing, $73 for carpenter work, $48 for painting. He then sold the house for $3265. What did he gain?

10. Two persons start from the same point and travel in opposite directions, one at the rate of 45 miles a day and the other 36 miles a day. How far apart will they be in 16 days?

11. A dealer bought 535 barrels of pork at $8 a barrel. He sold 245 barrels of it at $10 a barrel and the remainder at $7 a barrel. What did he gain or lose?

12. Mr. Brown has an income of $12650 a year. He spends $1650 for house rent and twice as much for other expenses. How much does he save in a year?

13. A sold 3 houses. For the first he received $2875, for the second $230 more than the first, and for the third as much as the first two. How much did he receive for all?

14. Mr. C bought 14 cows at $23 each, 7 horses at $96 each, 34 oxen at $57 each, and 300 sheep at $2 each. He sold the whole for $3842. What did he gain?

15. A merchant having $7632 deposited in his bank, drew out for the purchase of dry-goods, $1867; groceries, $362; boots and shoes, $218; hardware, $160. What amount had he left in the bank?

DIVISION

51. *Division* is finding how many times one number is contained in another.

52. The *Dividend* is the number to be divided.

53. The *Divisor* is the number by which to divide.

54. The *Sign* of division is a short horizontal line with a dot above and one below it ÷. The divisor follows the dividend as \$6 ÷ 2 or \$6 ÷ \$2. It may be written $\frac{\$6.}{2}$ 2)\$6, or \$6(2.

55. The *Quotient* is the number obtained by dividing, and shows how many times the divisor is contained in the dividend.

1. When the dividend does not contain the divisor an exact number of times, the part of the dividend left is called the *remainder,* and it must be less than the divisor.

2. As the remainder is always a part of the dividend, it is always of the same name and kind.

3. When there is no remainder, the division is said to be *exact.*

4. When the process of dividing is performed mentally, and the results only are written, the operation is termed *Short Division.*

5. When the whole process of division is written, the operation is termed *Long Division.*

SHORT DIVISION

56. *When the divisor consists of one figure.*

1. Divide 693 by 3.

SOLUTION
DIVISOR   3)693   DIVIDEND
QUOTIENT   231

Find the quotient of each of the following:

(2)	(3)	(4)	(5)	(6)	(7)
2)864	3)936	5)550	2)6248	3)9636	4)4884

(8)	(9)	(10)	(11)	(12)	(13)
2)8624	3)9306	4)80480	3)30609	2)20840	5)5055

14. Divide 1712 by 8.

SOLUTION

8)1712
$\overline{\quad 214}$

Solve the following problems:

(15)	*(16)*	*(17)*	*(18)*	*(19)*	*(20)*
4)1720	5)3675	6)4992	7)2674	8)9296	9)11916

21. At $9 a barrel how many barrels of flour can be bought for $10926?

22. How many calves can I buy with $2940 at $7 per head?

23. Eight men own 22824 sheep. If they have the same number, how many has each?

24. Five men invest equally in business. The total investment was $23770. How much did each invest?

25. When broadcloth was selling at $6 per yard I paid $97362 for an invoice. How many yards did I buy?

LONG DIVISION

57. *When the divisor is expressed by more than one figure.*

1. Divide 5848 by 43.

SOLUTION

43)5848(136
$\quad$ 43
$\quad\overline{154}$
$\quad$ 129
$\quad\overline{258}$
$\quad$ 258
$\quad\overline{}$

From the preceding we induce the following:

To Divide Whole Numbers

a. Write the divisor on the left of the dividend.

b. Find how many times the divisor is contained in the least number of figures which will contain it at the left of the dividend, and write the result in the quotient at the right.

c. Multiply this quotient figure by the divisor, subtract the product from the figures of the dividend used and to the remainder bring down the next figure of the dividend, which divide as before, and so continue until all the figures of the dividend have been brought down and used.

d. If, after bringing down a figure, the divisor is too large to be contained in the dividend, write a cipher in the quotient and bring down the next figure in the dividend.

e. If there is a remainder in the quotient it should be written at the right of the quotient with the divisor under it.

NOTES.—1. If any remainder be *equal to* or *greater* than the divisor, the quotient figure is too *small,* and must be increased.

2. If the product of the divisor by the quotient figure be *greater* than the dividend, the quotient figure is too *large,* and must be diminished.

PROBLEMS

2. Divide 7668 by 36.   *6.* Divide 24492 by 78.

3. Divide 1666 by 49.   *7.* Divide 11808 by 246.

4. Divide 3484 by 52.   *8.* Divide 49815 by 369.

5. Divide 20995 by 85.   *9.* Divide 1720 by 5.

10. Divide 32740 by 154.

11. Divide 32572 by 34.

12. Divide 1554768 by 216.

13. Divide 93840 by 63.   Remainder 33.

14. Divide 10557312 by 32. *15.* Divide 3931476 by 278.

16. Divide 352417 by 29.   Remainder 9.

17. Divide 75088 by 52.   *18.* Divide 1674918 by 189.

19. Divide 42647 by 92.   Answer, $463\frac{51}{92}$.

20. Divide 163513 by 497.   *21.* Divide 127960 by 267.

22. Divide 36928 by 69.

23. At $76 each, how many horses can be bought for $9728?

24. 274 wagons cost $29592. What was the average price per wagon?

25. B paid $19872 for 207 acres of land.   What was the price per acre?

26. A farmer raised 9765 bushels of wheat on 223 acres. What was the yield per acre?

27. A manufacturing company made a profit of $37840 in 215 days. What was the daily profit?

58. *When there are ciphers at the right of the divisor.*

1. Divide 34216 by 900.

SOLUTION
9|00)342|16
    38   QUOTIENT. 16 REMAINDER

EXPLANATION.—Cut off the ciphers at the right of the divisor and the same number of figures from the right of the dividend. Divide the remaining figures of the dividend by the remaining figures of the divisor. To the remainder, if any, annex the figures cut off from the dividend.

PROBLEMS

2. Divide 362076 by 60.   *3.* Divide 350000 by 14000.

4. Divide 28520 by 1500.   *5.* Divide 18065 by 1200.

6. Divide 1720800 by 3600.   *7.* Divide 968050 by 12900.

8. Divide 836290 by 1780.   *9.* Divide 924000 by 2640.

10. Divide 7802030 by 6070.

11. At $150 each, how many horses can be bought for $11250?

12. A real estate dealer received $8640 for 36 lots. What was the average price of the lots?

PROBLEMS IN ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION

59. *1.* A merchant owes $59, $84, $36 and $17. He pays $42. How much does he still owe?

2. A bought four bills of goods amounting to $740, $965, $342 and $196. He paid $1262 on them. How much does he still owe for the goods?

3. A laborer bought a coat worth $16, a vest worth $3, and a pair of pants worth $5. How many days had he to work to pay for his suit, his services being worth $2 a day?

4. I bought 95 bushels of wheat at 78 cents per bushel, and

3

paid for it in cloth at 19 cents per yard. How many yards were required?

5. Four men have $2890. The first has $610; the second $593; the third $975. How much has the fourth man?

6. A clerk's income is $898 a year and his expenses are $2 a day. How much will he save in two years of 365 days each?

7. How many pounds of cheese at 9 cents per pound must be given for 27 pounds of tea worth 80 cents a pound?

8. A person sells 15 tons of hay at $22 per ton, and receives in payment a carriage worth $125, a cow worth $45, a colt worth $40, and the balance in cash. How much money ought he to receive?

9. A deposited in bank $426, $743, $860, $910, $85, $1269 and $26. He withdrew from the bank $705, $210, $500. How much had he then in the bank?

10. I sold 48 horses at $86 each, and with the money bought calves at $8 each. How many calves did I buy?

11. I bought two pieces of land, one of 360 acres at $29 per acre, the other of 194 acres at $41 per acre. What did both pieces cost me?

12. A bought 175 cows at $23 each, and 268 hogs at $13 each. B bought 79 cows at $34 each, and 170 hogs at $11 each. How much more did A pay than B?

13. I bought a farm for $2165, paying $725 cash, and the balance in monthly payments of $120 each. How many monthly payments did I make?

14. A teacher receives a salary of $75 per month for 1 year. His board cost $20 per month, other expenses $180 for the year. With the balance of his money he buys books at $6 a volume. How many books can he buy?

15. A man bought 26 tons of coal at $6 per ton. For how much must he sell it per ton to gain $52 on the 26 tons?

16. B had $9628, of which he invested $1860 in bank stock, $2108 in horses, $974 in hogs, $1218 in sheep, and the remainder in land. What did the land cost him?

17. A widow has a farm valued at $6720; also three houses worth $12530, $11324 and $9875. She has a daughter

and two sons. To the daughter she gives one-fourth the value of the farm, and one-third the value of the houses, and then divides the remainder equally among the boys. How much did each receive?

18. A is worth $960, B is worth five times as much as A, less $600, and C is worth three times as much as A and B and $300 more. What are B and C each worth and how much are they all worth?

19. A grocer bought 7 barrels of fish at $18 per barrel, but one barrel proved to be bad. This he sold for $5 less than cost, and the remainder at an advance of $3 per barrel. Did he gain or lose, and how much?

20. If a clerk's salary is $600 a year and his personal expenses $320, how many years before he will be worth $6600 if he has $1000 at the present time?

21. A man went into business with a capital of $1500; the first year he gained $800, the second year $950, the third year $700, and the fourth year $625, when he invested the whole in a cargo of tea and doubled his money. What was he then worth?

22. A butcher bought 9 calves for $54, and 8 lambs for $16. How much more did he pay for a calf than a lamb?

23. A farmer sold to a grocer 380 pounds of pork, at 7 cents per pound; 150 pounds of butter, at 17 cents per pound, and one cheese weighing 53 pounds, at 9 cents per pound, and received in payment 22 pounds of sugar, at the rate of 11 pounds for a dollar; 225 pounds of flour at 4 cents per pound; 15 pounds of tea, at 65 cents per pound; one half-barrel of fish, at $18 per barrel, and one set of dishes worth $27. Did the farmer owe the grocer, or the grocer the farmer, and how much?

24. A speculator bought 200 bushels of apples for $90, and sold the same for $120. How much did he make per bushel?

25. A milkman sold 120 quarts of milk, at 5 cents per quart, and took in payment one pig worth $1.50, and the balance in sheeting, at 10 cents per yard. How many yards did he receive?

26. A manufacturing company made 928 yards of cloth on Monday, 1142 yards on Tuesday, 1468 on Wednesday and 876

yards on Thursday, and sold 1940 yards of it. How many yards remained?

27. A man bought a farm, paying $1690 down. After making three other payments of $945, $765 and $2740, the amount unpaid was $3628. He sold the farm for $8278. What was his loss?

28. A merchant's store was insured for $21650, and his goods for $17645. The store was valued at $25000, and the goods at $22564. Both were destroyed by fire. What was his loss?

29. A, B, C and D formed a partnership. A invested $720 more than B; C invested $1280 less than B, and D invested $945 less than A and C together. What was the total investment if B invested $2450?

30. A speculator bought 200 acres of land at $45 per acre, and afterwards sold 150 acres of it for $11550; the balance he sold at a gain of $5 per acre, and received in payment $250 cash, and the balance in sheep at $5 each. How many sheep did he receive? What was his profit on the land?

FACTORING

60. An *Exact Divisor* of a number is a number that will be contained in it an integral number of times.

61. A *Factor* of a number is an integral divisor of the number. The factors of 18 are 2, 3 and 3; of 30 are 2, 3 and 5.

62. A *Prime Number* is one which cannot be divided or separated into factors, except 1 and that number; as 3, 5, 7, 11 and 13.

63. A *Composite Number* is one which can be resolved or separated into integral factors; as 4, 6, 9, 10 and 12.

64. An *Even Number* is one that is exactly divisible by 2; as 8, 16, 24 and 30.

65. An *Odd Number* is one that is not exactly divisible by 2; as 5, 9, 7, 15 and 21.

66. A *Prime Factor* is one that is a prime number; as 3, 11, 17 and 23.

67. *Factoring* is finding the factors of a number.

1. What are the prime factors of 42?

SOLUTION
2)42
3)21
‾7‾

From the preceding definitions and example we have the following:

To Separate a Number Into Its Prime Factors

a. Divide the given number by any prime factor.

b. Divide the quotient, if a composite number, by any prime factor and so continue dividing until the quotient is a prime number.

c. The divisors and the last quotient are the prime factors.

Find the prime factors of the following numbers:

2.	9	*11.*	108	*20.*	300	*29.*	1347
3.	12	*12.*	120	*21.*	385	*30.*	2898
4.	18	*13.*	124	*22.*	465	*31.*	4292
5.	36	*14.*	186	*23.*	525	*32.*	9222
6.	35	*15.*	225	*24.*	644	*33.*	8151
7.	42	*16.*	231	*25.*	656	*34.*	3476
8.	50	*17.*	288	*26.*	756	*35.*	5270
9.	66	*18.*	294	*27.*	1273	*36.*	8892
10.	96	*19.*	297	*28.*	2920	*37.*	13717

CANCELLATION

68. Since dividing both dividend and divisor by the same number does not change the quotient, we may strike out or reject equal factors from both dividend and divisor without affecting the result.

69. *Cancellation* is striking out equal factors from both dividend and divisor. Cancellation is a short method of division.

70. The *Sign* of cancellation is an oblique line, / ; when drawn across a number, it shows the number has been cancelled: as, $\not{4}$, $\not{2}$, $\not{6}$ and $\not{3}$.

The most common method is to write the dividend above a horizontal line and the divisor beneath it, although a vertical line with the divisor on the left and the dividend on the right is sometimes used.

If the dividend or divisor is a composite number it should first be resolved into its prime factors, before beginning the operation of cancellation.

1. Divide $4 \times 8 \times 3 \times 5 \times 7$ by $2 \times 3 \times 4 \times 5$.

SOLUTION

$$\frac{\overset{4}{\not{4}} \times \not{8} \times \not{3} \times \not{5} \times 7}{\not{2} \times \not{3} \times \not{4} \times \not{5}} = 28$$

EXPLANATION.—Strike out the factors 3, 4 and 5 from both dividend and divisor. Since 2 in the divisor is a factor of 8 in the dividend, we cancel these, leaving the factors 4 times 7 in the dividend, or 28, the quotient.

We therefore have the following:

To Find a Quotient by Cancellation

a. Write the numbers composing the dividend above a hori-zontal line and those composing the divisor below it.

b. Cancel all factors common to both dividend and divisor.

c. Multiply the remaining factors of the upper numbers or dividend together, and the remaining factors, if any, of the lower numbers or divisor together. Divide the upper product by the lower and the result will be the quotient desired.

NOTES.—1. Rejecting a factor from any number is dividing the number by that factor.

2. When a factor is cancelled, the unit, 1, is supposed to take its place.

3. *One* factor in the dividend will cancel only *one equal* factor in the divisor.

4. If all the factors or numbers of the divisor are cancelled, the product of the remaining factors of the dividend will be the quotient.

5. By many it is thought more convenient to write the factors of the dividend on the right of a *vertical* line, and the factors of the division on the left.

Solve the following problems by cancellation: ·

2. Divide $3 \times 7 \times 4 \times 5 \times 11$ by $5 \times 7 \times 4 \times 3$.

3. Divide $2 \times 4 \times 6 \times 8 \times 10$ by $2 \times 4 \times 5 \times 6$.

4. Divide $8 \times 6 \times 12 \times 15$ by $5 \times 3 \times 4 \times 2 \times 3$.

5. Divide $9 \times 8 \times 6 \times 18$ by $2 \times 3 \times 4 \times 3 \times 2$.

6. Divide $7 \times 6 \times 3 \times 14$ by $2 \times 3 \times 2 \times 7$.

7. Divide $4 \times 6 \times 12 \times 15 \times 8$ by $2 \times 3 \times 6 \times 5 \times 4$.

8. Divide $3 \times 6 \times 9 \times 12 \times 24$ by $3 \times 4 \times 6 \times 8 \times 5$.

9. How many yards of calico at $.08 per yard will pay for 14 bushels of turnips at $.28 per bushel?

10. If 8 yards of cloth cost $32, what will 19 yards cost?

11. How many hogs at $9 each will pay for 36 barrels of flour at $6 each?

12. I exchanged 48 dozen of eggs at 10 cents per dozen for sugar at 8 cents per pound. How many pounds did I get?

13. I bought 8 boxes of boots, each containing 9 dozen pairs at $18 per dozen, and gave in payment 12 loads of wheat of 54 bushels each. What did I receive per bushel for the wheat?

14. A cubic yard is 3 feet deep, 3 feet long and 3 feet wide. How many cubic yards in 24 feet long, 18 feet wide and 6 feet deep?

GREATEST COMMON DIVISOR

71. A *Common Divisor* of two or more numbers is a number that will divide them integrally.

72. The *Greatest Common Divisor* of two or more numbers is the greatest number that will divide them integrally, or is the product of all their common prime factors.

Numbers are said to be *prime to each other* when they have no common divisor.

If a number divides two or more others, it will also divide their sum and difference, and also the sum and difference of any product of them, because it divides them when they are taken separately. Hence if one number divide the whole of another number, and also one part of it, it will divide the other part also. Thus, 9 divides 45 and 27, and also their difference, 18.

1. Find the Greatest Common Divisor of 84 and 203.

SOLUTION

```
84)203(2
  168
  35)84(2
     70
     14)35(2
        28
         7)14(2
           14
           ‾‾
```

EXPLANATION.—Write the smaller number as the divisor and the larger as the dividend. We know that the G. C. D., whatever it is, must divide 84, and if it divides 84 it will also divide twice that number or 168. If it divides 203 and 168 it must divide their difference, 35, according to the principle laid down above. Repeating this argument until the end, it must divide 7 and 14, and as 7 is contained in 14 without a remainder, 7 is the largest number that will divide itself and 14, and hence is the G. C. D.

From the preceding principles and explanations we have the following rule:

To Find the Greatest Common Divisor

*a. Divide the greater number by the less, **and** then the less by the remainder, until nothing is left.*

b. The last divisor will be the Greatest Common Divisor.

NOTE.—1. If it is desired to find the G. C. D. of more than two numbers, first find the G. C. D. of two of them, and then find the G. C. D. of that and another, and so on.

2. Find the greatest common divisor of 247 and 323.

3. Find the greatest common divisor of 316 and 664.

4. What is the greatest common divisor of 532 and 1274?

5. What is the greatest common divisor of 741 and 1273?

6. What is the greatest common divisor of 1313 and 4108?

7. What is the greatest common divisor of 468 and 1266?

8. What is the greatest common divisor of 224, 280 and 336?

9. I have four rooms, respectively 16, 20, 24 and 32 feet wide. How wide must carpet be that will just fit each room?

10. The sides of a lot are 112, 126, 140 and 168 feet. What is the greatest length of boards that can be used in fencing it without cutting them?

11. A farmer has four pieces of land. The first has 240 acres; the second, 180 acres; the third, 300 acres; the fourth, 360 acres. He wishes to divide them into the largest possible fields of equal side. How many acres will there be in each field?

LEAST COMMON MULTIPLE

73. A *Multiple* of a number is any number that will integrally contain it. Thus, 18, 24 and 30 are multiples of 6.

74. A *Common Multiple* of two or more numbers is any number that will integrally contain each of them. Thus, 24 is a common multiple of 2, 4, 6 and 8.

75. The *Least Common Multiple* of two or more numbers is the least number that will integrally contain each of them. Thus, 36 is the least common multiple of 6, 12 and 18.

76. The *Least Common Multiple* contains all the prime factors of each of the given numbers.

It is plain that the least common multiple of numbers that have no common factor is the product. But if the numbers have a common factor, that factor is to be taken only once unless

it is repeated in any of the numbers, in which case it must be used as many times as a factor of the multiple, as the greatest number of times it appears in any of the given numbers.

1. Find the least common multiple of 4, 6, 9 and 12.

SOLUTION

$2)\overline{4, 6, 9, 12}$
$2)\overline{2, 3, 9, 6}$
$3)\overline{1\ \ 3\ \ 9\ \ 3}$
$\overline{\quad\ \ 3}$

$2 \times 2 \times 3 \times 3 = 36$ L. C. M.

EXPLANATION.—Write the numbers in a horizontal line. Since 2 is a factor of some of the numbers, we know that it must be a factor of the L. C. M., hence we divide as many numbers as possible by 2 and bring down the quotients and undivided numbers below. By inspection we see that 2 is again a factor of some of the numbers brought down, and hence another 2 must be a factor of the L. C. M. We therefore divide by 2 and bring down the quotients and undivided numbers again. We next divide by 3 for a like reason and bring down as before. We now have but 3 left, and as we would gain nothing by dividing it by itself, we multiply together the several divisors and last quotient, and the result is the L. C. M. sought.

Suggestion.—The L. C. M. of 12, 9, 6 and 4 cannot be less than 12; 12 contains all of the factors of itself, 6 and 4 and 3, one of the factors of 9. It therefore remains to multiply the remaining factors 12 and 3 to find the L. C. M., which is 36.

From this example we derive the following rule:

To Find The Least Common Multiple

a. Write the numbers in a horizontal line.

b. Divide by any prime number that will exactly divide one or more of the given numbers, and write the quotients and undivided numbers beneath. Continue to divide until no number will divide more than one of the quotients.

c. Multiply the several divisors and the last quotient together and the result will be the L. C. M.

2. What is the least common multiple of 27, 45, 63 and 81?

3. What is the least common multiple of 10, 12, 14, 16 and 18? Find the L. C. M. of the following:

4. 32, 48, 64 and 80.

5. 18, 30, 42 and 60.

6. 32, 48, 72 and 96.

7. 3, 6, 9, 12, 15, 21 and 24.

8. 30, 40, 50, 60, 70 and 80.

9. 7, 14, 28, 56, 112 and 224.

10. What is the smallest piece of land that can be divided into fields of 16, 24 or 30 acres each?

11. What is the least amount of money with which you can purchase chickens at 12 cents each, ducks at 20 cents each, turkeys at 60 cents each or geese at 75 cents each?

12. How many bushels will a bin contain from which 9, 18 or 30 bushels can be taken an even number of times?

13. A can shear 42 sheep in a day, B 63, and C 54. What is the number of sheep in the smallest flock that would furnish exact days' labor for each of them shearing aione?

FRACTIONS

77. A *Fraction* is one or more of the equal parts of a unit.

78. A *Fractional Unit* is one of the equal parts of a unit, as, one-third, one-fourth, one-seventh.

79. A *Fraction* is one or more fractional units, as, one-half, three-fourths, seven-ninths.

80. The *Unit of a Fraction* is the thing divided. The unit of the fraction two-thirds of a dollar, is $1; of four-fifths is 1; of six-elevenths of a bushel is 1 bushel.

81. A *Fraction* is expressed by writing one number above and another below a short horizontal line; as, one-fifth, $\frac{1}{5}$; three-fourths, $\frac{3}{4}$.

82. The *Terms* of a fraction are the two numbers used to express it.

83. The *Denominator* shows the number of parts into which the unit is divided and is written below the line.

84. The *Numerator* shows the number of parts (fractional units) taken, and is written above the line.

In $\frac{4}{5}$ bushels, 5 is the denominator and shows the unit (1 bushel) is divided into 5 equal parts; 4 is the numerator and shows that 4 of the 5 equal parts are taken. $\frac{1}{5}$ is the fractional unit.

85. A *Fraction* is read by naming the number and kind of fractional units; as, $\frac{3}{5}$, three-fifths; $\$\frac{2}{7}$, two-sevenths of a dollar; $\frac{9}{20}$ bushel, nine-twentieths of a bushel.

Read the following fractions:

1.	$\frac{1}{8}$.	*4.*	$\frac{8}{19}$.	*7.*	$\frac{4}{17}$.	*10.*	$\frac{17}{44}$.
2.	$\frac{3}{4}$.	*5.*	$\frac{6}{11}$.	*8.*	$\frac{6}{15}$.	*11.*	$\frac{32}{87}$.
3.	$\frac{4}{6}$.	*6.*	$\frac{5}{12}$.	*9.*	$\frac{18}{45}$.	*12.*	$\frac{11}{49}$.

Write the following in the form of fractions:

13. Three-fifths.

14. Six-sevenths.

15. Seven-elevenths.

16. Ten forty-sevenths.

17. Forty-one sixtieths.

18. Fifty-six seventy-firsts.

19. Twelve-fourteenths.

20. Sixteen-twentieths.

21. Eight twenty-sixths.

22. Thirty-four seventy-fifths.

23. Sixty-nine eighty-ninths.

24. Ninety-three ninety-sixths.

86. A *Proper Fraction* is one whose numerator is less than its denominator; as, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{12}$.

87. An *Improper Fraction* is one whose numerator equals or exceeds its denominator; as, $\frac{3}{3}$, $\frac{5}{4}$, $\frac{10}{9}$.

88. A *Mixed Number* is one expressed by an integer and a fraction; as, $3\frac{1}{4}$, read three and one-fourth; the word *and* being placed between the integer and fraction.

89. A *Complex Fraction* is one which has a fraction in one or both of its terms; as, $\frac{\frac{1}{2}}{\frac{2}{3}}$, $\frac{4}{1\frac{3}{5}}$, $\frac{6\frac{7}{8}}{11}$. The first is read one-half over two-thirds, etc.

90. A *Compound Fraction* consists of two or more single fractions joined together by the word *of*; as, $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{6}$.

91. *Reduction* is changing the form of a number or fraction without changing its value; 2 may be changed to $\frac{4}{2}$; 3 to $\frac{12}{4}$; $\frac{6}{2}$ to 3; $\frac{3}{9}$ to $\frac{1}{3}$, while the value is not altered.

A Fraction is an indicated division, the numerator being the dividend, the denominator being the divisor and the value of the fraction the quotient.

The value of the fraction is the ratio existing between the numerator and denominator. Therefore,

1. Increasing the numerator increases the value of the fraction.

2. Diminishing the denominator increases the value of the fraction.

3. Diminishing the numerator diminishes the value of the fraction.

4. Increasing the denominator diminishes the value of the fraction.

5. Increasing both numerator and denominator the same number of times does not alter the value of the fraction, for the ratio between them remains the same.

6. Diminishing both numerator and denominator in the same proportion does not alter the value of the fraction.

REDUCTION OF FRACTIONS

92. *Reduction of Fractions* consists in changing their form without altering their value.

A fraction is in its *lowest terms* when its numerator and denominator have no common divisor.

As fractions may be reduced to *lower terms* by division, they may also be reduced to *higher terms* by multiplication.

ORAL PROBLEMS

1. $\frac{4}{4}$ = how many whole ones? $\frac{5}{5}$, $\frac{6}{6}$, $\frac{7}{7}$, $\frac{8}{8}$.

2. $\frac{8}{8}$ = how many fourths? How many halves?

3. $\frac{6}{12} = \frac{?}{6}$, $\frac{?}{4}$, $\frac{?}{2}$, $\frac{?}{24}$, $\frac{?}{36}$, $\frac{?}{48}$.

4. $\frac{16}{32} = \frac{?}{16}$, $\frac{?}{8}$, $\frac{?}{4}$, $\frac{?}{2}$.

5. Change $\frac{25}{75}$ to thirds.

6. Change $\frac{24}{72}$ to twelfths, to sixths, to thirds.

7. How many halves in $1\frac{2}{4}$, $\frac{8}{16}$, $\frac{16}{32}$, $\frac{48}{96}$?

8. How many thirds in $\frac{6}{9}$, $\frac{12}{18}$, $\frac{24}{36}$, $\frac{24}{72}$?

9. Compare $\frac{3}{4}$ with $\frac{18}{24}$; $\frac{7}{8}$ with $\frac{35}{40}$; $\frac{7}{9}$ with $\frac{54}{72}$.

93. *To reduce fractions to their lowest terms.*

1. Reduce $\frac{48}{60}$ to its lowest terms.

SOLUTION

$2)\frac{48}{60} = \frac{24}{30}$

$2)\frac{24}{30} = \frac{12}{15}$

$3)\frac{12}{15} == \frac{4}{5}$

From the solution we have the following rule:

To Reduce Fractions to Lowest Terms

a. Divide both terms of the fraction by any number that will divide them without a remainder.

b. Divide this result as before, and so continue to divide until no number will divide both without a remainder.

c. The last result will be the fraction in its lowest terms.

2. Reduce $\frac{144}{432}$ to its lowest terms, $\frac{119}{224}$, $\frac{315}{336}$, $\frac{378}{840}$.

3. Reduce the following to their lowest terms: $\frac{360}{900}$, $\frac{650}{950}$, $\frac{320}{1000}$, $\frac{324}{1224}$, $\frac{453}{1057}$, $\frac{528}{3264}$.

4. Express in its simplest form the quotient of 125 divided by 625.

5. Express in its simplest form the quotient of 272 divided by 425.

6. Divide 873 by 3395 and express the quotient in the lowest terms or simplest form.

7. Divide 323 by 437 and express the quotient in the lowest terms or simplest form.

ORAL PROBLEMS

1. In one apple are how many halves? 4ths?

2. Two peaches equal how many half peaches? fourth peaches?

3. $\frac{1}{2}$ equals how many 4ths? 8ths? 12ths?

4. $\frac{1}{4}$ equals how many 8ths? 12ths? 24ths? 36ths?

5. $\frac{3}{4}$ equals how many 8ths? 12ths? 24ths? 36ths?

6. $\frac{3}{4}$ equal how many 8ths? 12ths? 24ths? 36ths?

7. $\frac{5}{4}$ equals how many 8ths? 12ths? 24ths? 36ths?

8. $\frac{3}{8}$ equal how many 16ths? 24ths? 40ths? 64ths?

9. $\frac{7}{8}$ equal how many 16ths? 24ths? 40ths? 64ths?

10. How many 36ths in $\frac{3}{4}$? in $\frac{4}{6}$? in $\frac{5}{12}$?

11. How many 48ths in $\frac{5}{8}$? $\frac{5}{6}$? $\frac{7}{12}$? $\frac{9}{16}$? $\frac{7}{24}$?

94. *To reduce fractions to higher terms.*

Since fractions are reduced to *lower terms* by *dividing* both terms by a common factor, they are reduced to *higher terms* by *multiplying* both terms by a common factor.

1. Reduce $\frac{3}{4}$ to a fraction having 20 for its denominator.

SOLUTION

$20 \div 4 = 5$

$\dfrac{3 \times 5 = 15}{4 \times 5 = 20}$

Therefore we have the following rule:

To Reduce Fractions to Higher Terms

a. Divide the required denominator by the denominator of the fraction in order to find how many times the terms of the fraction must be increased.

b. Multiply both terms of the fraction by the quotient as found above.

2. Reduce $\frac{2}{5}$ to a fraction whose denominator is 15.

3. Reduce $\frac{4}{7}$ to a fraction whose denominator is 35.

4. Reduce $\frac{5}{9}$ to a fraction whose denominator is 63.

5. Reduce $\frac{8}{15}$ to a fraction whose denominator is 180.

6. Reduce $\frac{15}{16}$ to a fraction whose denominator is 128.

7. Reduce $\frac{8}{15}$ to a fraction whose denominator is 375.

8. Reduce $\frac{75}{112}$ to a fraction whose denominator is 896.

9. Reduce $\frac{100}{153}$ to a fraction whose denominator is 918.

10. Reduce $\frac{218}{355}$ to a fraction whose denominator is 2840.

95. *To reduce improper fractions to whole or mixed numbers.*

ORAL PROBLEMS

1. What is a unit? What is a mixed number?

2. How many ones in $\frac{4}{2}$? $\frac{8}{2}$? $\frac{9}{3}$? $\frac{12}{4}$?

3. How many ones in $\frac{16}{4}$? $\frac{24}{6}$? $\frac{27}{3}$? $\frac{96}{12}$?

4. Reduce to units $\frac{24}{8}$, $\frac{64}{8}$, $\frac{72}{9}$, $\frac{125}{25}$.

5. $\frac{15}{2} = 7\frac{1}{2}$; $7\frac{1}{2}$ is a mixed number.

6. $\frac{15}{2} =$ how many units and what part of a unit?

7. $\frac{25}{3} =$ what mixed number? $\frac{32}{3}$? $\frac{25}{6}$? $\frac{19}{7}$?

8. Reduce to whole or mixed numbers: $\frac{25}{3}$, $\frac{37}{4}$, $\frac{42}{8}$, $\frac{36}{10}$, $\frac{48}{9}$, $\frac{27}{3}$, $\frac{97}{6}$, $\frac{84}{3}$.

WRITTEN PROBLEMS

1. Reduce $\frac{66}{8}$ to a whole or mixed number.

SOLUTION

$\frac{66}{8} = 66 \div 8 = 8\frac{2}{8} = 8\frac{1}{4}$

Therefore:

To Reduce Improper Fractions to Integers or Mixed Numbers

a. Divide the numerator by the denominator.

NOTE.—1. When the denominator is an exact divisor of the numerator, the result will be a whole number.

2. In all answers containing fractions reduce the fractions to their lowest terms.

2. Reduce $\frac{16}{4}$ to a whole or mixed number.

3. Reduce $\frac{58}{7}$ to a whole or mixed number.

4. In $\frac{117}{5}$ of a bushel, how many bushels?

5. In $\frac{168}{8}$ of a mile, how many miles?

6. In $\frac{528}{24}$ of a pound, how many pounds?

7. In $\frac{216}{14}$ of a yard, how many yards?

8. In $\frac{625}{15}$ of a gallon, how many gallons?

9. In $\frac{942}{26}$ of a day, how many days?

10. In $\frac{263}{37}$ of an apple, how many apples?

11. Reduce $\frac{496}{12}$ of a foot to feet.

12. Reduce $\frac{168}{14}$ of an hour to hours.

13. Reduce $\frac{210}{15}$ of an ounce to ounces.

14. Reduce $\frac{306}{18}$ to an integer.

15. Reduce $\frac{528}{24}$ to an integer.

16. Reduce $\frac{887}{51}$ to an integer.

96. *To reduce whole or mixed numbers to fractional form.*

ORAL PROBLEMS

1. How many halves in 2? in 4? in 16? in 24?

2. How many halves in $2\frac{1}{2}$? in $7\frac{1}{2}$? in $9\frac{1}{2}$?

3. How many thirds in $8\frac{1}{3}$? in 15? in $15\frac{2}{3}$?

4. $12\frac{3}{4} = \frac{?}{4}$; $16\frac{2}{3} = \frac{?}{3}$; $12\frac{7}{8} = \frac{?}{8}$; $14\frac{2}{7} = \frac{?}{7}$.

5. $7\frac{1}{5} = \frac{?}{5}$; $12\frac{1}{2} = \frac{?}{2}$; $11\frac{1}{9} = \frac{?}{9}$; $24 = \frac{?}{6}$.

WRITTEN PROBLEMS

1a. Reduce 24 yards to fourths.

SOLUTION

$$
\begin{array}{r}
24 \\
4 \\
\hline
96 \\
\hline
4
\end{array}
$$

1b. Reduce $8\frac{2}{3}$ to an improper fraction.

SOLUTION

$$
\begin{array}{r}
8\frac{2}{3} \\
3 \\
\hline
26 \\
\hline
3
\end{array}
$$

Therefore, we have the following rule:

To Reduce Whole and Mixed Numbers to Improper Fractions

a. Multiply the whole number by the given denominator and write the product over the given denominator. Or

b. Multiply the whole number by the denominator of the fraction, to the product add the numerator and write the result over the denominator.

Note.—A whole number is reduced to a fractional form by writing 1 under it for a denominator; thus, $9 = \frac{9}{1}$.

2. In 15 dollars, how many thirds of a dollar?

3. In 46 bushels, how many fifths of a bushel?

4. In 89 gallons, how many sixths of a gallon?

5. How many fifteenths in 28 feet?

6. How many twenty-fifths in 36 tons?

7. How many thirtieths in 45?

8. Reduce 92 to fortieths.

9. Reduce 108 to sixty-fourths.

10. Reduce 215 to seventy-sixths.

11. Change 36 to the form of a fraction.

12. Change 175 to the form of a fraction.

13. Change 320 to a fraction whose denominator shall be 8.

14. Change 536 to a fraction having 24 for its denominator.

15. Express 49 as a fraction with the same denominator as $\frac{12}{13}$.

16. In $5\frac{1}{2}$ dollars, how many half dollars?

17. In $23\frac{3}{4}$ weeks, how many fourths of a week?

18. In $123\frac{5}{6}$ pounds, how many sixths of a pound?

19. Express $27\frac{1}{2}$ as an improper fraction.

20. Express $66\frac{1}{8}$ as an improper fraction.

21. Express $15\frac{7}{18}$ as an improper fraction.

22. Reduce $23\frac{13}{28}$ to an improper fraction.

23. Reduce $234\frac{17}{31}$ to an improper fraction.

24. Reduce $1078\frac{4}{11}$ to an improper fraction.

25. Reduce $1186\frac{11}{15}$ to an improper fraction.

26. Reduce $2300\frac{19}{41}$ to an improper fraction.

97. *To reduce two or more fractions to the least common denominator.*

A *Common Denominator* is a denominator common to several fractions. Thus, in the fractions $\frac{3}{7}$, $\frac{5}{7}$ and $\frac{6}{7}$ the common denominator is 7.

The *Least Common Denominator* of several fractions is the least denominator to which all can be reduced. It is the least common multiple of their denominators.

ORAL PROBLEMS

1. $\frac{1}{2}$ = how many 4ths? 8ths? 24ths?

2. $\frac{3}{4}$ = how many 12ths? 24ths? 36ths?

3. $\frac{2}{3}$ = how many 12ths? 24ths? 36ths?

4. $\frac{3}{4}$ and $\frac{5}{6}$ each = how many 12ths? 24ths?

5. Change $\frac{5}{6}$ and $\frac{7}{8}$ each to 48ths, 24ths.

6. Change $\frac{2}{3}$ and $\frac{3}{8}$ each to a fraction having the same name.

7. Change $\frac{4}{7}$ and $\frac{5}{9}$ each to 63ds. 63 is the **L. C. D.** of these fractions.

8. Reduce $\frac{7}{8}$ and $\frac{5}{7}$ to their **L. C. D.**

9. Reduce $\frac{3}{4}$, $\frac{2}{3}$ and $\frac{5}{6}$ to their **L. C. D.**

10. Reduce $\frac{5}{3}$, $\frac{1}{6}$, $\frac{7}{8}$ and $\frac{5}{12}$ to their **L. C. D.** (24ths).

WRITTEN PROBLEMS

1. Reduce $\frac{3}{4}$, $\frac{5}{6}$ and $\frac{7}{8}$ to their least common denominator.

SOLUTION

$$2\,)\,4, 6, 8 \qquad\qquad 2 \times 2 \times 3 \times 2 = 24$$
$$2\,)\,\underline{2, 3, 4} \qquad\qquad\qquad \frac{3}{4} = \frac{18}{24}$$
$$\overline{1, 3, 2} \qquad\qquad\qquad \frac{5}{6} = \frac{20}{24}$$
$$\qquad\qquad\qquad\qquad \frac{7}{8} = \frac{21}{24}$$

We therefore have the following rule:

To Reduce Fractions to Their Least Common Denominator

a. Find the least common multiple of the given denominators and write this as the new denominators of the fractions.

b. Divide this common denominator by each of the given denominators and multiply each numerator by the corresponding quotient. The product will be the new numerator.

NOTE.—Reduce mixed numbers to improper fractions and all fractions to the lowest terms before beginning the operation.

2. Reduce $\frac{1}{3}$, $\frac{5}{6}$ and $\frac{7}{8}$ to their least common denominator.

3. Reduce $\frac{2}{5}$, $\frac{5}{8}$ and $\frac{7}{10}$ to their least common denominator.

4. Reduce $\frac{4}{7}$, $\frac{9}{10}$, $\frac{5}{14}$ and $\frac{11}{35}$ to their least common denominator.

5. Reduce $\frac{8}{9}$, $\frac{11}{12}$, $\frac{11}{18}$ and $\frac{17}{36}$ to their least common denominator.

6. Reduce $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$ and $\frac{1}{12}$ to their least common denominator.

7. Reduce $\frac{3}{5}$, $\frac{1}{8}$, $\frac{3}{10}$, $\frac{7}{15}$ and $\frac{17}{20}$ to their least common denominator.

× 8. Reduce $\frac{6}{7}$, $\frac{7}{8}$, $\frac{8}{9}$, $\frac{9}{10}$ and $\frac{11}{12}$ to their least common denominator.

9. Reduce $\frac{4}{5}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{7}{12}$, $\frac{9}{16}$ and $\frac{5}{18}$ to their least common denominator.

10. Change $\frac{4}{5}$, $\frac{7}{15}$, $3\frac{2}{3}$, 9 and $\frac{7}{9}$ to fractions having the least common denominator.

11. Change $2\frac{1}{8}$, $1\frac{6}{7}$, $\frac{7}{8}$, $1\frac{1}{4}$ and 6 to fractions having the least common denominator.

12. Change $\frac{3}{5}$, $\frac{7}{10}$, $\frac{8}{15}$, $\frac{9}{20}$, $\frac{1}{2}\frac{2}{5}$ and $\frac{2}{3}\frac{3}{0}$ to fractions having the least common denominator.

13. Change $2\frac{8}{4}$, $\frac{3}{8}$, $\frac{4}{5}$ and $\frac{7}{15}$ to fractions having the least common denominator.

/14. Change $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $1\frac{1}{12}$, $1\frac{5}{16}$ and $1\frac{7}{18}$ to fractions having the least common denominator.

15. Change $2\frac{7}{10}$, $6\frac{1}{4}$, $\frac{9}{10}$, 7, $\frac{3}{5}$ and $1\frac{1}{2}$ to fractions having the least common denominator.

ADDITION OF FRACTIONS

98. *Addition of Fractions* is the process of finding the sum of two or more fractional numbers.

We have seen that no quantities can be added together except they are of the same kind or denomination. Not only must fractions be parts of the same kind of units, but they must have the same denominators before they can be added.

ORAL PROBLEMS

1. What is the sum of $\frac{1}{8}$, $\frac{3}{8}$ and $\frac{4}{8}$?

2. What is the sum of $\frac{3}{4}$, $\frac{3}{12}$ and $\frac{1}{4}$?

3. A has $\frac{7}{8}$ and B $\frac{5}{8}$. How many eighths have both? How many units?

4. Find the sum of $\frac{1}{2}$ and $\frac{1}{3}$; $\frac{1}{4}$ and $\frac{1}{5}$; $\frac{1}{5}$ and $\frac{1}{6}$.

5. Find the sum of $\frac{2}{3}$ and $\frac{3}{4}$; $\frac{3}{4}$ and $\frac{2}{5}$; $\frac{2}{5}$ and $\frac{5}{6}$.

6. Find the sum of $\frac{2}{3}$ and $\frac{5}{6}$; $\frac{7}{8}$ and $\frac{3}{4}$; $\frac{7}{12}$ and $\frac{2}{3}$.

7. Find the sum of $2\frac{1}{2}$ and $3\frac{1}{3}$; $4\frac{1}{4}$ and $5\frac{1}{5}$; $3\frac{1}{3}$ and $4\frac{1}{6}$.

8. Find the sum of $3\frac{3}{4}$ and $6\frac{1}{2}$; $3\frac{3}{5}$ and $4\frac{3}{10}$; $7\frac{5}{6}$ and $\frac{3}{4}$.

9. One boy has $\$3\frac{3}{4}$ and another has $\$2\frac{1}{2}$. How many dollars have both?

10. A boy rode $3\frac{7}{8}$ miles in a wagon, $11\frac{3}{4}$ miles in a train, and walked $2\frac{1}{2}$ miles. How far did he go in all?

11. How many years are $12\frac{3}{8}$ years and $18\frac{3}{4}$ years?

12. How many hours are $15\frac{2}{3}$ hours and $17\frac{7}{6}$ hours?

13. What is the sum of $3\frac{3}{4}$ bushels, $4\frac{7}{8}$ bushels and $5\frac{3}{8}$ bushels?

14. How many dollars in $\$2\frac{1}{2} + \$3\frac{3}{4} + \$6\frac{7}{10}$ and $\$8\frac{9}{20}$?

WRITTEN PROBLEMS

1. Find the sum of $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{5}{6}$.

SOLUTION

The L. C. M. of 2, 3, 4 and 6 is 12.

$$\frac{1}{2} = \frac{6}{12}$$
$$\frac{2}{3} = \frac{8}{12}$$
$$\frac{3}{4} = \frac{9}{12}$$
$$\frac{5}{6} = \frac{10}{12}$$

$\frac{6}{12} + \frac{8}{12} + \frac{9}{12} + \frac{10}{12} = \frac{33}{12} = 2\frac{9}{12} = 2\frac{3}{4}$.

From the preceding problem and explanation we have the following:

To Add Fractions

a. Reduce the fractions to their least common denominator.

b. Add the numerators and under their sum write the denominator.

c. In mixed numbers, add the whole numbers and fractions separately, then add their sums.

Note.—If the mixed numbers are small, they may be reduced to improper fractions, and then added after the usual method.

2. Add $\frac{1}{8}$, $\frac{5}{8}$, $\frac{5}{8}$ and $\frac{7}{8}$.   6. Add $\frac{3}{5}$, $\frac{5}{6}$, $\frac{7}{8}$ and $\frac{11}{15}$.

3. Add $\frac{1}{10}$, $\frac{3}{10}$, $\frac{2}{10}$ and $\frac{2}{10}$.   7. Add $\frac{4}{7}$, $\frac{9}{14}$, $\frac{5}{12}$ and $\frac{5}{8}$.

4. Add $\frac{2}{3}$, $\frac{5}{6}$, $\frac{1}{8}$ and $\frac{3}{10}$.   8. Add $7\frac{2}{3}$, $9\frac{3}{4}$, $11\frac{5}{6}$ and $9\frac{3}{8}$.

5. Add $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$.   9. Add $6\frac{5}{6}$, $7\frac{7}{12}$, $8\frac{11}{18}$ and $9\frac{15}{24}$.

10. What fraction is equal to $1\frac{1}{2} + 2\frac{2}{3} + 3\frac{3}{4} + 4\frac{4}{5} + 5\frac{5}{6} + 6\frac{6}{7}$?

11. What is the sum of $17\frac{3}{4}$, $18\frac{5}{12}$, $26\frac{1}{24}$ and $10\frac{5}{6}$?

12. Add $4\frac{7}{8}$, $1\frac{17}{18}$, $2\frac{23}{24}$, $3\frac{20}{27}$ and $5\frac{1}{12}$.

13. What fraction is equal to $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64}$?

14. What is the sum of $125\frac{1}{7}$, $327\frac{5}{12}$ and $25\frac{1}{4}$?

15. What is the sum of $1\frac{14}{15}$, $8\frac{2}{5}$, $3\frac{9}{32}$ and $14\frac{3}{8}$?

16. I have four fields. The first contains $17\frac{1}{3}$ acres; the second, $11\frac{3}{5}$ acres; the third, $21\frac{5}{8}$ acres; the fourth, $19\frac{5}{12}$ acres. How many acres have I?

17. Jones paid $\$7\frac{3}{4}$ for a coat, $\$2\frac{1}{5}$ for a hat, $\$3\frac{1}{2}$ for pants, $\$1\frac{1}{4}$ for a vest and $\$4\frac{2}{5}$ for shoes. What did he pay for all?

18. A merchant bought $38\frac{1}{4}$ yards of calico, $103\frac{3}{4}$ yards of muslin, $80\frac{3}{4}$ yards of flannel and $26\frac{1}{4}$ yards of gingham. How many yards did he buy?

19. A family used $\frac{3}{5}$ of a ton of coal in September, $\frac{7}{12}$ of a ton in October, $\frac{5}{9}$ of a ton in November, $\frac{14}{15}$ of a ton in December and $1\frac{1}{2}$ tons in January. How much did they use in the five months?

20. A farmer received $\$7\frac{1}{4}$ for a hog, $\$23\frac{1}{2}$ for a cow, $\$11\frac{3}{4}$ for a sheep and $\$123\frac{9}{20}$ for a horse. How much did he receive for all?

21. A man invested $\$2460\frac{2}{3}$ in land, $\$1432\frac{5}{9}$ in cotton and $\$1314\frac{5}{6}$ in mining stock. What was his total investment?

22. A has on deposit in a savings bank $\$46\frac{3}{5}$, B has on deposit $\$28\frac{7}{10}$, C has on deposit $\$76\frac{1}{2}$ and D has on deposit $\$96\frac{3}{4}$. What is the total amount of their deposits?

23. A collector received from one man $\$5\frac{4}{10}$, from another $\$11\frac{3}{4}$, from another $\$18\frac{9}{10}$, and from another $\$1\frac{4}{5}$. How much did he collect in all?

24. Add $1026\frac{11}{20}$, $1875\frac{3}{4}$, $5634\frac{4}{9}$ and $4327\frac{7}{8}$.

25. A lady went shopping, and expended for car fare $\frac{1}{6}$ of a dollar, for thread $\frac{11}{20}$ of a dollar, for needles $\frac{1}{10}$ of a dollar, for gloves $1\frac{1}{4}$ dollars, for a hat $7\frac{1}{8}$ dollars, for a dress $32\frac{7}{10}$ dollars. What was the total amount of her expenditures?

26. A farmer sold $437\frac{1}{2}$ bushels of corn for $\$127\frac{4}{5}$; $268\frac{5}{12}$ bushels of wheat for $\$186\frac{7}{10}$; $728\frac{2}{3}$ bushels of oats for $\$245\frac{13}{25}$ and $421\frac{5}{9}$ bushels of rye for $\$216\frac{3}{20}$. How many bushels did he sell and what was the total sum received?

27. A merchant bought four pieces of gingham containing the following number of yards in each piece: $43\frac{1}{2}$, $44\frac{2}{4}$, 45 and $46\frac{3}{4}$ (generally written 43^1, 44^2, 45 and 46^3). How many yards did he buy?

28. How many yards in the following pieces of denim: 36^1, 42^1, 41, 39, 38^2, 43, 44^3, 46^2, 41, 38^1, 39^2, 34, 36^3, 38, 41^2, 42, 41^1, 43^1, 44^2, 45, 46, 44, 43^3 and 46^2?

SUBTRACTION OF FRACTIONS

99. *Subtraction of Fractions* consists in finding the difference between two fractional numbers.

Since quantities of different kinds or denominations cannot be subtracted it follows that in order to subtract fractions they must be parts of the same kind of units and must have the same denominators.

ORAL PROBLEMS

1. Find the value of $\$2$ less $\$\frac{3}{4}$; $\$4$ less $\$\frac{7}{8}$.

2. Find the value of $\$3\frac{1}{2}$ less $\$1\frac{1}{4}$; $\$5\frac{1}{4}$ less $\$2\frac{3}{4}$.

3. Find the difference between $\frac{3}{4}$ and $\frac{2}{3}$; $\frac{5}{6}$ and $\frac{7}{8}$.

4. If you spend $\frac{1}{4}$ and $\frac{1}{2}$ of your money, what part remains?

5. From $\frac{7}{8}$ of a barrel of sugar $\frac{3}{4}$ was sold. What part remains?

6. $7\frac{3}{4}$ inches and how many inches make one foot?

7. $15\frac{2}{3}$ hours and how many hours equal one day?

8. $7\frac{3}{8}$ feet from 3 yards leave how many feet?

9. $3\frac{1}{4} + 2\frac{1}{2} + 3\frac{7}{8} + 2\frac{2}{3}$ from $15\frac{11}{12} = ?$

10. $7\frac{1}{4} + 8\frac{2}{3}$ from $10\frac{3}{4} + 6\frac{1}{3} = ?$

WRITTEN PROBLEMS

1. From $\frac{2}{3}$ subtract $\frac{3}{8}$.

SOLUTION

The L. C. M. of 3 and 8 is 24.

$\frac{2}{3} = \frac{16}{24}$ $\frac{16}{24} - \frac{9}{24} = \frac{7}{24}$

$\frac{3}{8} = \frac{9}{24}$

From this we derive the following rule:

To Subtract Fractions

a. Reduce the fractions to their least common denominator.

b. Subtract the numerators and under the difference write the denominator.

c. Reduce the result to its lowest terms.

NOTE.—To subtract mixed numbers, if they are small, reduce them to improper fractions and subtract the less from the greater; if they are large, reduce the fractions to a common denominator and then subtract the subtrahend of both integers and fractions from the minuend of both integers and fractions.

2. From $\frac{3}{4}$ take $\frac{1}{4}$.

3. From $1\frac{0}{11}$ take $\frac{4}{11}$.

4. From $1\frac{7}{12}$ take $\frac{1}{3}$.

5. From $1\frac{3}{18}$ take $1\frac{5}{15}$.

6. From $\frac{3}{40}$ take $1\frac{5}{12}$.

7. From $11\frac{2}{3}$ take $7\frac{3}{4}$.

8. From $25\frac{1}{5}$ take $11\frac{7}{15}$.

9. From $8\frac{1}{2}$ take $3\frac{7}{8}$.

10. From $4\frac{1}{5}$ take $1\frac{4}{5}$.

11. Subtract $2\frac{7}{8}$ from 13.

12. Subtract $130\frac{3}{8}$ from $285\frac{1}{2}$.

13. Subtract $\frac{4}{8}\frac{7}{5}$ from $4\frac{1}{8}\frac{3}{4}$.

14. Subtract $\frac{6}{18}\frac{5}{9}$ from $4\frac{4}{75}\frac{9}{6}$.

15. Find the difference between $\frac{5}{8}\frac{9}{0}$ and $\frac{8}{15}$.

16. Find the difference between $20\frac{4}{5}$ and $9\frac{1}{22}\frac{9}{2}$.

17. Find the difference between $5\frac{2}{3}\frac{3}{2}$ and $3\frac{2}{7}$.

18. A boy who had $5 lost $1\frac{1}{5}$. How much had he left?

19. I paid $23\frac{4}{5}$ for a cow and $19 for some sheep. How much more did the cow cost than the sheep?

20. A clerk received $14\frac{1}{4}$ for a week's work and spent $9\frac{7}{10}$ of it. How much did he have remaining?

21. A teacher who receives $75 for a month's work, paid $17\frac{1}{4}$ for board, $1\frac{1}{8}$ for light and $9\frac{2}{3}$ for clothes. How much of it did he have at the end of the month?

22. A man having $87\frac{3}{5}$, paid $23\frac{3}{4}$ for a coat, $12\frac{9}{10}$ for a pair of pants, $4\frac{17}{20}$ for a vest, $5 for a hat and $\frac{7}{10}$ for a neck-tie. How much money had he left?

23. A father having $7500, divided it among his four children as follows: To the eldest he gave $2375\frac{3}{4}$; to the second he gave $1843\frac{3}{10}$; to the third $2162\frac{4}{5}$; and to the fourth the remainder. How many dollars did the fourth receive?

24. A merchant bought flour at $7\frac{3}{4}$ per barrel and sold it at $8\frac{1}{5}$. What did he gain per barrel?

25. From the sum of $25\frac{8}{5}$ and 9 take the sum of $3\frac{1}{4}$ and $11\frac{6}{7}$.

26. A grocer having $1000 in money, expends $324\frac{3}{8}$ for flour, $128\frac{7}{9}$ for sugar, $48\frac{2}{3}$ for canned goods, $76\frac{1}{4}$ for coffee, $98\frac{11}{12}$ for tea, $216\frac{5}{7}$ for sundry other articles, and pays one month's rent of his store, $50. How much money has he remaining?

27. From the sum of $56\frac{7}{12}$ and $89\frac{3}{4}$ take the difference between $5\frac{4}{5}$ and $81\frac{7}{16}$.

28. A farmer had three fields. The first contained $320\frac{11}{16}$ acres, the second $225\frac{2}{5}$ acres and the third $160\frac{2}{3}$ acres. He sold $540\frac{3}{8}$ acres. How many acres had he left?

29. A bought $6\frac{5}{8}$ pounds of A sugar, $4\frac{3}{4}$ pounds of B sugar, $7\frac{8}{9}$ pounds of C sugar and $11\frac{7}{8}$ pounds of granulated sugar. He found $5\frac{19}{24}$ pounds to be damaged. What was the weight of the good sugar received?

30. A real estate dealer bought a house and lot for $3100. He paid $218\frac{4}{5}$ for repairs; $290\frac{8}{15}$ for taxes; $16\frac{3}{10}$ for advertising and $38\frac{5}{8}$ for expenses in selling it. He collected $37\frac{1}{2}$ in rent for the property while he owned it, and sold it for $4000 in cash. How much was his gain?

MENTAL REVIEW OF ADDITION AND SUBTRACTION

100. To add two fractions whose numerators are each 1, take the sum of the denominators for the numerator, and the product of the denominators for the denominator of the sum. Thus, $\frac{1}{4} + \frac{1}{5} = \frac{9}{20}$.

Find the value of:

1. $\frac{1}{8}+\frac{1}{6}$.	6. $\frac{1}{9}+\frac{1}{7}$.	11. $\frac{1}{3}+\frac{1}{5}$.
2. $\frac{1}{3}+\frac{1}{7}$.	7. $\frac{1}{11}+\frac{1}{8}$.	12. $\frac{1}{4}+\frac{1}{3}$.
3. $\frac{1}{5}+\frac{1}{9}$.	8. $\frac{1}{6}+\frac{1}{14}$.	13. $\frac{1}{5}+\frac{1}{10}$.
4. $\frac{1}{2}+\frac{1}{6}$.	9. $\frac{1}{4}+\frac{1}{7}$.	14. $\frac{1}{7}+\frac{1}{2}$.
5. $\frac{1}{6}+\frac{1}{11}$.	10. $\frac{1}{2}+\frac{1}{3}$.	15. $\frac{1}{6}+\frac{1}{5}$.

100A. To subtract fractions whose numerators are each 1, take the difference of the denominators for the numerator and the product of the denominators for the denominator of the remainder. Thus, $\frac{1}{4}-\frac{1}{5}=\frac{1}{20}$.

Find the value of:

1. $\frac{1}{6}-\frac{1}{7}$.	5. $\frac{1}{3}-\frac{1}{5}$.	9. $\frac{1}{6}-\frac{1}{8}$.
2. $\frac{1}{3}-\frac{1}{4}$.	6. $\frac{1}{4}-\frac{1}{9}$.	10. $\frac{1}{3}-\frac{1}{7}$.
3. $\frac{1}{8}-\frac{1}{9}$.	7. $\frac{1}{5}-\frac{1}{11}$.	11. $\frac{1}{7}-\frac{1}{9}$.
4. $\frac{1}{4}-\frac{1}{6}$.	8. $\frac{1}{2}-\frac{1}{5}$.	12. $\frac{1}{6}-\frac{1}{8}$.

100B. To add two fractions whose numerators are greater than 1, take the sum of the products of the numerator of each by the denominator of the other for the numerator, and the product of the denominators for the denominator of the sum. Thus, $\frac{2}{3}+\frac{3}{4}=\frac{17}{12}$. ($2 \times 4 + 3 \times 3 = 17$, and $3 \times 4 = 12$.)

Find the value of:

1. $\frac{2}{3}+\frac{3}{5}$.	5. $\frac{4}{5}+\frac{3}{7}$.	9. $\frac{3}{4}+\frac{5}{7}$.
2. $\frac{3}{4}+\frac{2}{5}$.	6. $\frac{2}{7}+\frac{3}{8}$.	10. $\frac{5}{6}+\frac{7}{8}$.
3. $\frac{3}{5}+\frac{5}{8}$.	7. $\frac{2}{9}+\frac{4}{5}$.	11. $\frac{2}{5}+\frac{3}{11}$.
4. $\frac{3}{7}+\frac{4}{9}$.	8. $\frac{3}{8}+\frac{2}{3}$.	12. $\frac{4}{7}+\frac{3}{4}$.

100C. To subtract two fractions whose numerators are greater than 1, take the difference of the products of the numerator of each by the denominator of the other for the numerator, and the product of the denominators for the denominator of the remainder. Thus, $\frac{3}{4}-\frac{2}{3}=\frac{1}{12}$. ($3 \times 3 - 2 \times 4 = 1$, and $3 \times 4 = 12$.)

MULTIPLICATION OF FRACTIONS

101. *A fraction is multiplied* by multiplying the numerator or dividing the denominator.

ORAL PROBLEMS

1. At $\$\frac{1}{4}$ for 1 dozen eggs, what is the cost of 3 dozen?

2. At $\$\frac{3}{4}$ for a chicken, what will 5 chickens cost?

3. If a boy has $\frac{2}{3}$ of a bushel, what would 5 boys have?

4. 3 times $\frac{1}{4} = \frac{?}{4}$; $6 \times \frac{1}{4} = \frac{?}{4}$; $8 \times \frac{1}{4} = \frac{?}{4}$; $9 \times \frac{1}{4} = \frac{?}{4}$.

5. 5 times $\frac{1}{4} = \frac{?}{4}$; $5 \times \frac{3}{4} = x$; $5 \times \frac{3}{8} = x$; $5 \times \frac{5}{6} = x$.

6. 7 times $\frac{3}{4} = x$; $7 \times \frac{2}{8} = x$; $7 \times \frac{3}{8} = x$; $7 \times \frac{5}{6} = x$.

7. 4 times $1\frac{1}{2} = x$; $4 \times 2\frac{1}{2} = x$; $4 \times 3\frac{2}{3} = x$; $4 \times 2\frac{5}{6} = x$.

8. If a man earns $\$2\frac{1}{2}$ a day, how much will he earn in 4 days?

9. If a bushel of clover seed costs $\$2\frac{3}{4}$, what will 5 bushels cost?

10. $6 \times 3\frac{3}{4} = x$; $7 \times 2\frac{2}{3} = x$; $8 \times 1\frac{5}{6} = x$; $9 \times \frac{3}{4} = x$.

102. *To multiply a fraction by a whole number.*

WRITTEN PROBLEMS

1. If 1 hat costs $\frac{3}{4}$ of a dollar, what will 6 hats cost?

SOLUTION

$$\frac{3}{4} \times 6 = \frac{18}{4} = 4\frac{2}{4} = 4\frac{1}{2}$$

EXPLANATION.—Since 1 hat cost 3-fourths of a dollar, 6 hats will cost 6 times 3-fourths of a dollar or 18-fourths of a dollar, which is $\$4\frac{1}{2}$.

NOTE.—Always divide the denominator when it is exactly divisible by the multiplier.

2. Multiply $\frac{3}{7}$ by 5.

3. Multiply $\frac{5}{12}$ by 9.

4. Multiply $\frac{8}{9}$ by 4.

5. Multiply $\frac{7}{18}$ by 6.

6. Multiply $\frac{8}{25}$ by 10.

7. Multiply $\frac{9}{14}$ by 12.

8. Multiply $\frac{13}{68}$ by 9.

9. Multiply $\frac{42}{162}$ by 27.

10. Multiply $\frac{23}{90}$ by 14.

11. Multiply $\frac{85}{125}$ by 8.

12. If a man earn $9\frac{3}{5}$ dollars per week, how many dollars can he earn in 7 weeks?

13. Multiply $125\frac{3}{4}$ by 6.

SOLUTION

$$
\begin{array}{r}
125\frac{3}{4} \\
6 \\
\hline
4\frac{1}{2} \\
750 \\
\hline
754\frac{1}{2}
\end{array}
$$

14. Multiply $315\frac{5}{9}$ by 9.   *15.* Multiply $256\frac{11}{12}$ by 15.

16. Multiply $80\frac{9}{16}$ by 14.

17. Find the cost of 12 yards of ribbon at $\$\frac{5}{8}$ per yard.

18. Find the cost of 128 bushels of oats at $\$\frac{2}{5}$ per bushel.

19. At $\$\frac{1}{3}$ per pound what will 16 pounds of butter cost?

20. If a ton of hay cost $\$11\frac{3}{4}$ what will 15 tons cost?

103. *To multiply a whole number by a fraction.*

ORAL PROBLEMS

1. At $4 per bushel what will $\frac{1}{2}$ of a bu. cost?

2. At $9 per ton what will $\frac{1}{2}$ of a ton cost?

3. What is $\frac{1}{2}$ of 8; $\frac{1}{2}$ of 12; $\frac{1}{2}$ of 13; $\frac{1}{2}$ of 15?

4. What is $\frac{1}{4}$ of 12; $\frac{1}{4}$ of 16; $\frac{1}{4}$ of 24; $\frac{1}{4}$ of 36?

5. What is $\frac{3}{4}$ of 12; $\frac{3}{4}$ of 16; $\frac{3}{4}$ of 24; $\frac{3}{4}$ of 36?

6. What is $\frac{1}{8}$ of 17; $\frac{1}{8}$ of 25; $\frac{1}{8}$ of 35; $\frac{1}{8}$ of 51?

7. What is $\frac{3}{8}$ of 17; $\frac{3}{8}$ of 25; $\frac{3}{8}$ of 35; $\frac{3}{8}$ of 51?

8. $\frac{3}{5} \times 15 = x$; $\frac{3}{7} \times 21 = x$; $18 \times \frac{3}{6} = x$; $15 \times \frac{5}{8} = x$.

WRITTEN PROBLEMS

1. At $9 per ton what will $\frac{2}{3}$ of a ton of coal cost?

SOLUTION

```
    9
    2
  3)18
    6
```

From this solution we see that multiplying by a fraction consists in *multiplying by the numerator and dividing by the denominator.*

2. Multiply 5 by $\frac{4}{15}$.   *5.* Multiply 120 by $\frac{13}{18}$.

3. Multiply 32 by $\frac{3}{8}$.   *6.* Multiply 105 by $\frac{17}{21}$.

4. Multiply 100 by $\frac{9}{25}$.   *7.* Multiply 86 by $\frac{25}{38}$.

8. At $9 a bushel what will $\frac{2}{3}$ of a bushel of clover seed cost?

9. Multiply 184 by $6\frac{5}{8}$.

SOLUTION

```
   184
    6⅝
  115 = ⅝ × 184
  1104
  1219
```

EXPLANATION.—Multiply by the fraction $\frac{5}{8}$ and the whole number 6, and add the products together. The result will be the product required.

10. Multiply 52 by $8\frac{3}{4}$.   *12.* Multiply 135 by $26\frac{4}{9}$.

11. Multiply 76 by $11\frac{3}{8}$.   *13.* Multiply 258 by $42\frac{11}{23}$.

14. Multiply 156 by $\frac{27}{89}$.

15. If a railroad train runs 36 miles an hour, how far will it run in $15\frac{3}{4}$ hours?

16. If a mill is worth \$2650 and B owns $\frac{7}{12}$ of it, how much is B's share worth?

17. What will 216 barrels of pork cost at \$6$\frac{3}{4}$ per barrel?

18. At \$2$\frac{7}{8}$ a cord, what will 18 cords of wood cost?

104. *To multiply a fraction by a fraction.*

ORAL PROBLEMS

1. If $\frac{1}{4}$ of $\frac{4}{9}$ is $\frac{1}{9}$ what is $\frac{3}{4}$ of $\frac{4}{9}$?

2. If $\frac{1}{5}$ of $\frac{10}{13}$ is $\frac{2}{13}$ what is $\frac{4}{5}$ of $\frac{10}{13}$?

3. What is $\frac{2}{3}$ of $\frac{3}{4}$? $\frac{3}{4}$ of $\frac{8}{15}$? $\frac{3}{5}$ of $\frac{10}{13}$.

4. What is $\frac{1}{3}$ of $\frac{4}{5}$? $\frac{1}{4}$ of $\frac{3}{8}$? $\frac{1}{5}$ of $\frac{3}{4}$?

5. What is $\frac{2}{3}$ of $\frac{4}{5}$? $\frac{3}{4}$ of $\frac{3}{8}$? $\frac{4}{5}$ of $\frac{3}{4}$?

WRITTEN PROBLEMS

1. What will $\frac{4}{5}$ of a yard of flannel cost at $\frac{5}{6}$ of a dollar per yard?

SOLUTION

$\frac{4}{5} \times \frac{5}{6} = \frac{20}{30} = \frac{2}{3}$

$$\text{or,} \quad \frac{\overset{2}{\cancel{4}}}{\cancel{5}} \times \frac{\cancel{5}}{\underset{3}{\cancel{6}}} = \frac{2}{3}$$

Therefore we have the following rule:

To Multiply Fractions

a. Reduce mixed numbers to improper fractions.

b. Multiply the numerators together and multiply the denominators together. Under the product of the numerators, write the product of the denominators.

c. Reduce to its simplest form.

NOTE.—Cancel all factors common to numerators and denominators.

2. Multiply $\frac{3}{4}$ by $\frac{4}{9}$.   *5.* Multiply $4\frac{1}{5}$ by $\frac{6}{7}$.

3. Multiply $\frac{7}{8}$ by $\frac{4}{5}$.   *6.* Multiply $2\frac{2}{3}$ by $19\frac{3}{8}$.

4. Multiply $1\frac{1}{24}$ by $\frac{36}{55}$.   *7.* Multiply $16\frac{1}{7}$ by $40\frac{1}{10}$.

8. Multiply $34\frac{5}{6}$ by $\frac{19}{20}$.   *9.* Multiply $18\frac{7}{10}$ by $10\frac{5}{14}$.

10. What is the product of $\frac{3}{4}$, $1\frac{1}{3}$ and $\frac{5}{9}$?

11. What is the product of $2\frac{6}{7}$, $\frac{4}{5}$, 3 and $8\frac{2}{3}$?

12. What is the product of $\frac{7}{12}$, $\frac{5}{6}$, $1\frac{2}{4}$ and $3\frac{1}{4}$?

13. What is the product of $4\frac{1}{5}$, $5\frac{1}{3}$, $6\frac{3}{4}$ and $7\frac{1}{5}$?

NOTE.—Fractions with the word *of* between them are sometimes called *compound fractions.* The word *of* is simply an equivalent for the sign of multiplication, $\times$, and signifies that the numbers between which it is placed are to be multiplied together.

14. Multiply $\frac{3}{4}$ of $\frac{9}{21}$ by $\frac{1}{6}$ of $9\frac{1}{3}$.

15. Multiply $\frac{3}{8}$ of $5\frac{2}{3}$ by $\frac{7}{12}$ of 38.

16. What is the product of 8, $\frac{2}{3}$ of $7\frac{1}{2}$, $\frac{4}{5}$, 16 and $3\frac{1}{2}$?

17. What is the value of $\frac{5}{6}$ of $\frac{4}{5}$ of $\frac{3}{2}$ of $\frac{1}{8}$?

18. What is the value of $\frac{1}{3}$ of $\frac{2}{7}$ of $\frac{8}{9}$ of $1\frac{1}{8}$?

19. What fraction is equal to $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$ of $\frac{7}{8}$ of $\frac{8}{9}$?

20. A man owning $\frac{5}{8}$ of a store sold $\frac{2}{3}$ of his share. What part of the whole store did he sell?

21. What will $\frac{3}{4}$ of a pound of tea cost at $\frac{5}{6}$ of a dollar per pound?

Find the value of the following expressions:

22. $\frac{4}{5}$ of 160.

23. $84 \times \frac{6}{7}$.

24. $1\frac{1}{2}$ of $\frac{6}{21}$.

25. $\frac{3}{4}$ times 144.

26. $\frac{9}{10}$ of $\frac{8}{15} \times 1\frac{3}{4}$.

27. $4\frac{3}{4} \times 9 \times \frac{1}{3}$ of $18\frac{3}{4}$.

28. $62\frac{1}{2}$ times $\frac{3}{8}$ of $\frac{7}{12}$ of $\frac{4}{7}$.

29. $\frac{1}{2}$ of $25 \times \frac{7}{10}$ of $26\frac{2}{3}$.

30. $(\frac{1}{4} + \frac{9}{10}) \times (\frac{3}{8} + 4\frac{1}{2})$.

31. $(2\frac{1}{2} - \frac{2}{5}) \times (4\frac{2}{3} - 3\frac{1}{7})$.

Where the mixed numbers are large, instead of reducing them to improper fractions they may be multiplied by the following method:

32. Multiply $36\frac{2}{5}$ by $9\frac{3}{4}$.

<div align="center">SOLUTION</div>

$$
\begin{array}{l}
36\frac{2}{5} \\
\underline{9\frac{3}{4}} \\
\frac{3}{10} \;=\; \text{product of}\;\; \frac{2}{5} \times \frac{3}{4}. \\
27 =\; \text{product of}\;\; 36 \times \frac{3}{4}. \\
3\frac{3}{5} =\; \text{product of}\;\; \frac{2}{5} \times 9. \\
\underline{324 =\; \text{product of}\;\; 36 \times 9.} \\
354\frac{9}{10}.
\end{array}
$$

Or, $36\frac{2}{5} \times 9\frac{3}{4} = \frac{\overset{9}{\cancel{1}}\overset{7}{\cancel{8}}\overset{2}{\cancel{2}}}{\cancel{5}} \times \frac{3\,9}{\underset{2}{\cancel{4}}} = \frac{3\,5\,4\,9}{1\,0}$ or $354\frac{9}{10}$.

33. Multiply $32\frac{2}{3}$ by $7\frac{5}{6}$.   *34.* Multiply $86\frac{9}{10}$ by $9\frac{3}{5}$.

35. What cost $128\frac{3}{5}$ barrels of pork at $\$8\frac{3}{4}$ per barrel?

36. A farmer sold $17\frac{3}{4}$ bushels of corn at $\$\frac{3}{5}$ per bushel. How much did he receive?

37. I bought $23\frac{1}{2}$ barrels of salt at $\$2\frac{3}{10}$ each. What did it cost me?

38. A farmer sold a quarter of a beef that weighed $523\frac{3}{4}$ pounds at $5\frac{3}{8}$c per pound. How much did he receive for the quarter?

39. At $6\frac{5}{8}$c per pound, what sum would be received for 3 hogs that weighed respectively $316\frac{3}{5}$, $411\frac{9}{16}$ and $374\frac{1}{4}$ pounds?

40. A grain dealer bought $28\frac{3}{5}$ bushels of rye from one man and $47\frac{3}{4}$ bushels from another. He paid $\$1\frac{3}{8}$ per bushel. What did the rye cost the dealer?

41. In 1 rod there are $16\frac{1}{2}$ feet. How many feet are there around a field that is $18\frac{5}{6}$ rods on each side and $14\frac{7}{16}$ rods on each end?

42. A who owned $\frac{1}{5}$ of a mill worth $\$7200$, sold $\frac{3}{4}$ of his share to B. How much did B pay A, and what part of the mill did he buy?

43. L. J. Camp sold 24 hogs that averaged $368\frac{1}{2}$ pounds at $8\frac{2}{5}$c per pound. How much did he receive for the hogs?

44. If a boy earns $\$1\frac{1}{5}$ per day, how much would he earn in $\frac{3}{5}$ of 4 weeks, allowing 4 days for time lost by sickness?

45. A. K. Case bought of J. M. Sims $2\frac{1}{2}$ dozen eggs at 11c per dozen, $1\frac{1}{2}$ pounds of Rio coffee at 32c per pound, 4 pounds A sugar at $9\frac{1}{2}$c per pound, $3\frac{1}{3}$ bushels of potatoes at 30c per bushel, 4 cans of tomatoes at $12\frac{1}{2}$c per can, 3 gallons kerosene at $11\frac{3}{4}$c per gallon, $\frac{1}{2}$ dozen lemons at 20c per dozen. Find the total amount of the purchase.

46. M. N. Oliver bought of P. S. Rawson $3\frac{1}{2}$ pounds of pork at 9c per pound, $5\frac{1}{2}$ pounds ham at $12\frac{1}{2}$c per pound, 8 pounds beef at $8\frac{1}{2}$c per pound, 16 pounds chicken at $7\frac{3}{4}$c per pound, 3 quarts oysters at $13\frac{1}{4}$c per quart, $4\frac{1}{2}$ pounds bacon at $10\frac{1}{4}$c per pound, $2\frac{1}{2}$ pounds sausage at 8c per pound, $12\frac{1}{2}$ pounds mutton at $8\frac{1}{4}$c per pound. What was the total cost?

47. Mrs. E. M. Cooper bought of Cook Bros. $4\frac{1}{2}$ yards of rib-

bon at 10c per yard, $3\frac{3}{5}$ yards of muslin at 6c per yard, $9\frac{1}{2}$ yards drilling at 8c per yard, 7 yards calico at $5\frac{2}{3}$c per yard, $11\frac{1}{4}$ yards flannel at 24c per yard, $9\frac{3}{4}$ yards carpet at 30c per yard, 16 yards linen at $10\frac{1}{4}$c per yard, $12\frac{1}{3}$ yards silk at $\$\frac{2}{3}$ per yard. How much should Mrs. Cooper pay Cook Bros.?

48. I bought 2 cords of wood at $\$5\frac{3}{4}$ per cord, and $3\frac{1}{2}$ tons of coal at $\$7\frac{7}{8}$ per ton. I gave the merchant two 20-dollar gold pieces. How much change should I receive?

49. If $17\frac{1}{3}$ yards of broadcloth are bought at $\frac{4}{9}$ of $7\frac{2}{5}$ dollars per yard and sold at $\frac{7}{8}$ of $\$5\frac{2}{11}$ per yard, what is the gain or loss?

DIVISION OF FRACTIONS

105. *A Fraction is divided* by dividing the numerator or multiplying the denominator. (See Sec. 92.)

106. *To divide a fraction by a whole number.*

ORAL PROBLEMS

1. If 3 pounds of butter cost $\$\frac{3}{8}$, what will 1 pound cost?

2. If 6 pounds of cheese cost $\$1\frac{2}{7}$ what will 1 pound cost?

3. Find the value of the following: $\frac{6}{7} \div 3 = x$; $1\frac{2}{7} \div 6 = x$; $\frac{27}{31} \div 9 = x$; $\frac{54}{63} \div 9 = x$; $\frac{25}{26} \div 5 = x$;

4. If 3 yards of calico cost $\$\frac{1}{8}$, what will 1 yard cost?

5. If 5 dozen eggs cost $\$\frac{7}{10}$, what will 1 dozen cost?

6. Find the value of the following: $\frac{3}{4} \div 4 = x$; $\frac{7}{8} \div 3 = x$; $\frac{5}{6} \div 7 = x$; $\frac{2}{3} \div 9 = x$.

7. A paid $\$6\frac{2}{3}$ for 5 bushels of clover seed, what did he pay per bushel? ($6\frac{2}{3} = \frac{20}{3}$.)

8. I paid $\$5\frac{1}{4}$ for 3 turkeys, find the cost of each.

9. Find the value of the following: $3\frac{3}{4} \div 5 = x$; $16\frac{2}{3} \div 10 = x$; $5\frac{3}{4} \div 6 = x$; $8\frac{1}{3} \div 6 = x$.

WRITTEN PROBLEMS

1. If 3 bushels of timothy cost $\frac{7}{8}$ of a dollar, what will 1 bushel cost?

SOLUTION

$$\frac{7}{8} \div 3 = \frac{7}{24}$$

NOTE.—We divide the numerator when it is exactly divisible by the divisor; otherwise we multiply the denominator.

2. Divide $\frac{4}{8}$ by 2.   *6.* Divide $\frac{7.5}{125}$ by 25.

3. Divide $\frac{9}{17}$ by 3.   7. Divide $\frac{7}{23}$ by 11.

4. Divide $\frac{25}{37}$ by 5.   *8.* Divide $\frac{45}{84}$ by 21.

5. Divide $\frac{63}{87}$ by 9.   *9.* Divide $\frac{125}{880}$ by 75.

10. If 6 pounds of cheese cost $\frac{7}{8}$ of a dollar, what will 1 pound cost?

11. At $4 a yard what part of a yard of broadcloth can be bought for $\frac{8}{11}$ of a dollar?

12. If 7 dozen eggs cost $\frac{12}{13}$ of a dollar, what will one dozen cost?

13. If 7 bushels of wheat cost $6\frac{3}{4}$ what will one bushel cost?

NOTE.—Reduce the mixed number to an improper fraction and divide as before.

14. If 7 dozen hammers cost $23\frac{1}{4}$, what will one dozen cost?

15. A farmer paid $563\frac{4}{5}$ for 4 horses. How much did he pay for each?

16. If 9 men consume $\frac{3}{4}$ of $5\frac{2}{3}$ pounds of meat in a day, how much does each man consume?

107. *To divide by a fraction.*

ORAL PROBLEMS

1. If coffee can be bought at the rate of $$\frac{1}{4}$ per pound, how many pounds can be bought for $$\frac{1}{2}$? $$\frac{3}{4}$? $$\frac{5}{4}$? $$\frac{1}{8}$? $$\frac{2}{8}$? $$\frac{3}{8}$? $$\frac{4}{8}$? $$\frac{5}{8}$? $1\frac{1}{2}$? $2\frac{1}{4}$?

2. Find the value of the following: $\frac{5}{8} \div \frac{1}{4}$; $\frac{3}{8} \div \frac{1}{4}$; $\frac{5}{6} \div \frac{1}{3}$; $\frac{7}{8} \div \frac{1}{6}$; $\frac{5}{9} \div \frac{1}{5}$?

3. Find the value of the following: $\frac{5}{8} \div \frac{3}{4}$; $\frac{3}{8} \div \frac{3}{4}$; $\frac{5}{6} \div \frac{2}{3}$; $\frac{7}{8} \div \frac{5}{6}$; $\frac{5}{9} \div \frac{2}{5}$.

4. If $2\frac{1}{2}$ bushels of oats cost $1\frac{1}{2}$ what is the cost of one bushel?

5. Find the value of the following: $3\frac{1}{3} \div 2\frac{1}{2}$; $1\frac{2}{3} \div 1\frac{4}{5}$; $3\frac{3}{4} \div 1\frac{7}{8}$; $5\frac{1}{3} \div 2\frac{1}{4}$.

108. The *Reciprocal* of a number is 1 divided by the number; thus the reciprocal of 3 is $\frac{1}{3}$.

109. Since the reciprocal of a number is 1 divided by that number the reciprocal of a fraction is that fraction inverted. Inverting a fraction shows how many times it is contained in 1.

5

1. At $\frac{3}{4}$ of a dollar a yard, how many yards of cloth can be bought for $9?

SOLUTION

$$\frac{\overset{3}{\cancel{9}}}{1} \times \frac{4}{\cancel{3}} = 12$$

From the foregoing principles and explanation we derive the following rule:

To Divide Fractions

a. Reduce whole or mixed numbers to improper fractions.

b. Invert the divisor, and multiply the dividend by the divisor inverted.

c. Reduce the result to simplest form.

 2. Divide 1 by $\frac{3}{4}$.   *5.* Divide $\frac{1}{2}$ by $\frac{7}{13}$.

 3. Divide $\frac{7}{8}$ by $\frac{2}{3}$.   *6.* Divide $\frac{2}{3}$ by $\frac{27}{28}$.

 4. Divide $\frac{4}{5}$ by $\frac{1}{7}$.   *7.* Divide $\frac{7}{9}$ by $\frac{14}{27}$.

 8. How many times is $\frac{4}{5}$ contained in $\frac{5}{6}$?

 9. How many times is $\frac{3}{10}$ contained in $2\frac{1}{4}$?

 10. How many times is $1\frac{2}{17}$ contained in $3\frac{9}{11}$?

 11. How many times is $\frac{1}{2}$ of $\frac{3}{4}$ contained in 28?

 12. How many times is $\frac{5}{8}$ of $\frac{2}{3}$ of $\frac{1}{4}$ contained in $\frac{2}{3}$ of $\frac{5}{6}$?

 13. How many times is $\frac{3}{8}$ of $\frac{7}{9}$ contained in $\frac{5}{6}$ of $\frac{19}{20}$?

 14. How many times is $11\frac{2}{3}$ contained in $\frac{1}{4}$ of $45\frac{1}{2}$?

 15. What is the quotient of $18\frac{1}{2}$ divided by $3\frac{2}{9}$?

 16. What is the quotient of $\frac{3}{5}$ of $8\frac{3}{6}$ divided by $7\frac{1}{5}$?

 17. What is the quotient of $\frac{1}{2}$ of $\frac{7}{8}$ divided by $4\frac{1}{3}$ times $\frac{5}{8}$?

 18. What is the quotient of $\frac{3}{8}$ of $\frac{4}{5}$ of $\frac{5}{9}$ divided by $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$?

 19. What is the value of $\dfrac{3\frac{1}{2}}{5\frac{1}{3}}$?

SOLUTION

$$\frac{3\frac{1}{2}}{5\frac{1}{3}} = \frac{\frac{7}{2}}{\frac{16}{3}} = \frac{7}{2} \div \frac{16}{3} = \frac{7}{2} \times \frac{3}{16} = \frac{21}{32}$$

 20. What is the value of $\dfrac{\frac{2}{3}}{\frac{5}{9}}$?

21. What is the value of $\dfrac{8\frac{3}{5}}{11\frac{6}{8}}$?

22. What is the value of $\dfrac{\frac{5}{16}}{4\frac{8}{9}}$?

23. What is the value of $\dfrac{5\frac{1}{14}}{8}$?

24. What is the value of $\dfrac{18\frac{2}{9}}{16}$?

25. What is the value of $\dfrac{\frac{2}{3} \text{ of } \frac{3}{4}}{2\frac{1}{4}}$?

26. What is the value of $\dfrac{\frac{2}{5} \text{ of } \frac{5}{6}}{\frac{7}{8} \text{ of } 1\frac{4}{5}}$?

27. What is the value of $\dfrac{\frac{3}{8} \text{ of } \frac{2}{3} \text{ of } 4}{2 \times \frac{1}{5}}$?

28. What is the value of $\dfrac{\frac{1}{4} + 3\frac{1}{2}}{5\frac{2}{3} - 3\frac{1}{6}}$?

29. What is the value of $\dfrac{16\frac{1}{2} + 3\frac{1}{8}}{11\frac{2}{3} + 4\frac{2}{9}}$?

30. What are the daily wages of a man who receives $14\frac{1}{4}$ for $3\frac{1}{2}$ days work?

31. How many bushels of wheat at $\frac{2}{3}$ per bushel can be bought for $6\frac{2}{3}$?

32. How many tons of coal at $4\frac{1}{2}$ can be bought for $25\frac{1}{3}$?

33. At $\frac{7}{10}$ per yard, how many yards can be bought for $6\frac{3}{10}$?

34. If $2\frac{1}{2}$ tons of hay cost $20, what will 1 ton cost?

35. I sold wheat at 90c per bushel and gained $\frac{1}{5}$ of what it cost. Find the cost per bushel.

EXPLANATION.—Let $\frac{5}{5}$ = the cost. Then $\frac{6}{5}$ of the cost = 90c and $\frac{1}{5}$ of the cost = 90 ÷ 6 = 15c and $\frac{5}{5}$ or the cost = 5 × 15 = 75c.

36. I sold a cow for $27 and lost $\frac{1}{10}$ of the cost. Find the cost of the cow.

37. A man bought a horse for $80, and a buggy for $\frac{4}{5}$ as much as the horse. The buggy cost $1\frac{3}{5}$ times as much as the harness. Find the cost of the harness.

ORAL REVIEW PROBLEMS

1. What is $\frac{1}{2}$ of 14? 21? 36? 75? 125?

2. What is $\frac{2}{3}$ of 24? 36? 48? 54? 63?

3. What is $\frac{3}{4}$ of 28? 42? 56? 64? 81?

4. 18 is $\frac{1}{2}$ of what number? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$?

5. 12 is $\frac{2}{3}$ of what number? $\frac{3}{4}$? $\frac{6}{7}$?

6. Count by $2\frac{1}{2}$ to 100; by $3\frac{1}{3}$; by $6\frac{1}{4}$; by $6\frac{2}{3}$; by $12\frac{1}{2}$; by $16\frac{2}{3}$.

Note.—Practice on this daily until it can be done rapidly and accurately.

7. The sum of two numbers is $12\frac{1}{2}$, one of the numbers is $7\frac{1}{4}$, what is the other number?

8. $\frac{1}{4}$ of 16 is $\frac{1}{5}$ of what number?

9. $\frac{3}{4}$ of 24 is $\frac{2}{3}$ of what number?

10. A has $\$12\frac{1}{2}$, B has 3 times as much as A and C has $\frac{1}{2}$ as much as A and B have. How many dollars have all?

11. At 3 for 4 cents, how many pears can be bought for 20 cents?

12. At 5 for 2 cents, how many apples can be bought for 30 cents?

13. If 5 bushels of oats cost $\$1.25$, what will 7 bushels cost?

14. A boy spent $\frac{3}{4}$ of his money and had $\$12\frac{1}{2}$ left, how many dollars had he at first?

15. Paid $\$3\frac{1}{4}$ for a pair of shoes and had $\frac{7}{8}$ of my money left, how much had I at first?

16. A has $\frac{1}{4}$ of his sheep in one pasture, $\frac{1}{3}$ in another and the balance, 60 in a third pasture, how many sheep had he in all?

17. A buys 20 apples at 2 for 4c and 30 more at 2 for 6c. He sells them all at the rate of 4 for 10c. Does he gain or lose and how much?

18. If 5 men can dig a trench in 16 days, what part can 3 men dig in 8 days?

Find the quotient of:

19. $\frac{9}{11} \div 3$.	*25.* $\frac{7}{12} \div 14$.	*31.* $12 \div \frac{3}{16}$.	*37.* $30 \div \frac{5}{6}$.
20. $\frac{18}{25} \div 6$.	*26.* $\frac{12}{7} \div 4$.	*32.* $15 \div \frac{7}{3}$.	*38.* $\frac{4}{3} \div 8$.
21. $\frac{21}{40} \div 7$.	*27.* $\frac{15}{17} \div 10$.	*33.* $25 \div 2\frac{1}{2}$.	*39.* $\frac{1}{2} \div \frac{1}{3}$.
22. $\frac{3}{16} \div 5$.	*28.* $6 \div \frac{2}{3}$.	*34.* $18 \div \frac{3}{8}$.	*40.* $\frac{2}{3} \div \frac{3}{4}$.
23. $\frac{6}{7} \div 6$.	*29.* $8 \div \frac{4}{7}$.	*35.* $\frac{5}{6} \div 15$.	*41.* $\frac{4}{5} \div \frac{2}{15}$.
24. $\frac{5}{11} \div 15$.	*30.* $9 \div \frac{3}{11}$.	*36.* $24 \div \frac{3}{8}$.	*42.* $\frac{5}{9} \div \frac{2}{3}$.

$43.$ $\frac{3}{4} \div \frac{7}{8}$. $47.$ $\frac{1}{2} \div \frac{5}{9}$. $51.$ $\frac{8}{9} \div \frac{4}{5}$. $55.$ $\frac{7}{16} \div \frac{3}{8}$.

$44.$ $16 \div \frac{8}{9}$. $48.$ $\frac{2}{3} \div \frac{6}{5}$. $52.$ $\frac{5}{6} \div \frac{9}{14}$. $56.$ $\frac{3}{7} \div 9$.

$45.$ $\frac{3}{8} \div 9$. $49.$ $12 \div \frac{4}{3}$. $53.$ $\frac{5}{7} \div \frac{21}{24}$. $57.$ $15 \div \frac{6}{7}$.

$46.$ $\frac{3}{16} \div 3$. $50.$ $7 \div \frac{3}{8}$. $54.$ $4 \div \frac{5}{9}$. $58.$ $24 \div \frac{3}{8}$.

$59.$ What will 12 pounds of tea cost at $\frac{3}{8}$ dollars per pound?

$60.$ What will $\frac{5}{16}$ of a ton of hay cost at \$18 per ton?

$61.$ Find the product of $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{7}$ and $\frac{1}{8}$.

$62.$ $\frac{5}{8}$ is what part of $\frac{4}{5}$?

$63.$ If a horse eats $\frac{3}{8}$ bushel of oats in a day, how long will 30 bushels last him?

$64.$ A crock of butter weighs $8\frac{1}{4}$ pounds, and the crock alone weighs $1\frac{1}{2}$ pounds. What is the value of the butter at $12\frac{1}{2}$ cents per pound?

$65.$ What will $9\frac{5}{8}$ cords of wood cost at $4\frac{1}{2}$ dollars per cord?

$66.$ At 36 bushels to the acre, what is the yield of $1\frac{4}{9}$ acres?

$67.$ A lady bought $5\frac{3}{4}$ yards of silk for $8\frac{5}{8}$ dollars, what was the price per yard?

$68.$ At $1\frac{5}{8}$ dollars per yard, how much cloth can be purchased for \$14?

$69.$ Sold a book for \$2.25 and gained $\frac{2}{3}$. What did the book cost me?

$70.$ At \$4.50 per week, what will five days' board cost?

$71.$ Find the cost of $\frac{3}{5}$ of a ton of coal at \$6.50 per ton.

$72.$ Find the cost of $\frac{3}{5}$ of a yard of silk at \$.60 per yard.

$73.$ A couch is worth \$9. For how much must it be sold to gain $\frac{3}{16}$?

$74.$ At $1\frac{3}{4}$ dollars per day of 10 hours, what will a man earn in $7\frac{1}{2}$ hours?

$75.$ If 10 bushels of apples will make 32 gallons of cider, how much cider will 7 bushels make?

$76.$ Find the cost of $\frac{3}{4}$ of a piece of cloth of 36 yards at $1\frac{1}{3}$ dollars per yard.

$77.$ A lady paid $\frac{2}{3}$ of $\frac{1}{2}$ of her money for a dress and $\frac{1}{2}$ of $\frac{2}{3}$ of it for a cloak. What part of her money did she spend?

$78.$ At 60c a dozen what is the cost of $\frac{1}{5}$ of $\frac{1}{2}$ of a dozen of oranges? What is the cost of one orange?

79. How many strips of carpet $\frac{3}{4}$ yard wide can be cut from a strip 9 yards wide?

80. John has $72 in the bank. He draws out $\frac{1}{12}$ of it each week for four weeks. How much has he left?

81. A farmer sold 10 doz. eggs at $16\frac{1}{2}$c a dozen and took his pay in sugar at $5\frac{1}{2}$c a pound. How many pounds of sugar did he get?

82. What is the cost of 16 pounds of coffee at $20\frac{1}{2}$c per pound? 24 lbs. of sugar at $6\frac{3}{8}$c per pound? 12 lbs. of rice at $5\frac{1}{4}$c per pound? $\frac{1}{8}$ barrel of flour at $6.44 per barrel? 20 pounds of oatmeal at $9\frac{1}{2}$c per pound? a $12\frac{3}{4}$ pound ham at $10\frac{1}{2}$c per pound?

REVIEW PROBLEMS

110. *1.* Reduce $\frac{1638}{2106}$ to its lowest terms.

2. Reduce $\frac{4}{9}$ to a fraction having 27 for its denominator.

3. Reduce $428\frac{2}{7}$ to an improper fraction.

4. Change $\frac{1331}{18}$ to a whole or mixed number.

5. Reduce $\frac{3}{5}$, $\frac{1}{4}$, $\frac{5}{8}$ and $\frac{2}{3}$ to their least common denominator.

6. Add $4\frac{1}{3}$, $\frac{7}{9}$ and $\frac{4}{5}$.

7. Add $23\frac{5}{8}$, $14\frac{3}{5}$, $16\frac{4}{7}$ and $1\frac{1}{8}$.

8. Subtract $4\frac{1}{3}$ from $6\frac{3}{8}$.

9. Find the difference between $\frac{2}{8}$ of $5\frac{4}{7}$ and $\frac{3}{4}$ of $2\frac{1}{5}$.

10. The less of two numbers is $326\frac{4}{7}$ and the greater is $749\frac{3}{16}$; what is their difference?

11. Find the difference between $3 \times \frac{2}{9} \times \frac{2}{5} \times 5\frac{5}{8}$ and $3\frac{1}{8} \times \frac{5}{7} \times 4 \times \frac{2}{5}$.

12. Divide $2\frac{5}{7}$ by $\frac{3}{16}$.

13. Divide $125\frac{3}{4}$ by $4\frac{5}{9}$.

14. A teacher who received $75 for a month's work, paid $17\frac{1}{4}$ for board, $1\frac{2}{3}$ for light and $9\frac{7}{12}$ for clothes. How much did he have at the end of the month?

15. Find the sum of $23\frac{3}{7}$, 6, $\dfrac{4\frac{2}{3}}{5\frac{2}{8}}$ and $\frac{2}{3}$ of $\frac{3}{4}$.

16. How many days must a boy work to receive $12\frac{1}{2}$ if he receives $1\frac{1}{4}$ per day?

17. A spent $\frac{2}{5}$ of his money and lost $\frac{3}{10}$ of his money, and then had $21. How much did he have at first?

18. John is 18 years old, and his age is $\frac{3}{4}$ of his sister's age. How old is his sister?

19. A speculator paid \$6428$\frac{7}{8}$ for 135$\frac{1}{2}$ acres of land. How much did it cost him per acre?

20. I sold $\frac{2}{3}$ of a flock of 18 sheep for \$26$\frac{2}{5}$. What was the price per head for the sheep?

21. A has \$40 which is 1$\frac{1}{4}$ times B's money. How many dollars has B?

22. I bought three pieces of carpet at \$1$\frac{1}{4}$ per yard. One piece contained 40$\frac{1}{4}$ yards, another 33$\frac{1}{3}$ yards, the other 35$\frac{5}{12}$ yards. What was the entire cost?

23. A merchant bought 9 dozen eggs at \$$\frac{1}{8}$ per dozen and paid for them in cloth worth \$$\frac{2}{5}$ per yard. How many yards of cloth did it require?

24. The product of two fractions is $\frac{4}{9}$, and one of the fractions is $\frac{3}{5}$. What is the other fraction?

25. If the dividend is 1$\frac{1}{2}$ and the divisor is $\frac{3}{8}$, what is the quotient?

26. If 2$\frac{1}{2}$ barrels of flour cost \$26$\frac{1}{4}$, what will 8$\frac{1}{3}$ barrels cost?

27. A and B worked for a certain sum. A worked 4$\frac{1}{2}$ days and received \$6$\frac{3}{4}$. How much did B receive if he worked 5$\frac{2}{3}$ days at the same rate?

28. A farmer sold $\frac{1}{5}$ of his sheep to one man and $\frac{1}{3}$ to another, when he found that he had 140 sheep left. How many had he at first?

29. A bought 150 tons of hay. He sold 35 tons at \$1$\frac{3}{5}$ per ton, 40 tons at \$5$\frac{1}{4}$ per ton and $\frac{2}{3}$ of the remainder at \$5$\frac{1}{2}$ per ton. How much money did he receive?

30. How many yards of cloth at \$$\frac{3}{8}$ per yard must be given for 15 tons of coal at \$4$\frac{1}{2}$ per ton?

31. In how many days will 3 horses eat 4$\frac{1}{2}$ bushels of oats if each horse eats $\frac{1}{6}$ of a bushel each day?

32. How many pounds of butter at \$$\frac{3}{16}$ per pound will pay for 48 bushels of corn at \$$\frac{3}{4}$ per bushel?

33. A man paid \$3500 for a farm and this was 2$\frac{1}{5}$ times the cost of the house which he built upon it. Find the cost of the farm and house together.

34. With $1⅘ I bought ⅔ of ¾ of ⅝ of a yard of cloth. At that rate what will 3 yards cost?

35. A merchant paid $25 for 50 gallons of molasses. He lost ⅕ by leakage and sold 20 gallons at $⅔. The remainder was sold so as to gain $5 on the whole. Find the selling price per gallon.

36. How many yards of cloth ⅞ yards wide will line 23½ yards, 1¼ yards wide?

37. A speculator bought 367½ bushels of wheat at $⅝ per bushel; he sold 126⅔ bushels at $⅚ per bushel. He afterwards bought 260 bushels at $⅝ per bushel, and then sold all he had at $1⅑ per bushel. What did he gain?

38. A and B own 280 horses. How many horses does each own, if B owns ⅔ as many as A?

39. If 11¾ bushels of apples cost $4₁⁷₀, what will be the cost of 19½ bushels?

40. A stone mason worked 11⅔ days, and after paying his board and other expenses with ¾ of his earnings, he had $20 left. How much did he receive a day?

41. What will 3₁⁹₀ acres of land cost, if 6⅔ acres cost $807?

42. How many yards of carpet ¾ yards wide will it require to carpet a room 7½ yards long and 4 yards wide?

43. A and B together have $364. B's money is equal to ¾ of A's. How many dollars has each?

44. Lyman can do a piece of work in 4 days and Farwell can do it in 5 days. How long will it take them, working together, to do it?

45. S. P. Bruce bought 40⅔ acres of land at $16¼ per acre. He sold 25½ acres to James Collins at $22⅓ per acre, and sold the remainder to D. E. White at $15₁⁷₀ per acre. How much did Bruce pay for the land, how much did he receive for it, and what was his gain?

46. A can do a piece of work in 10 days; B, in 15 days; C, in 12 days. How long will it take them all to do the work?

47. A gentleman, having 271½ acres of land, sold ⅓ of it, and gave ⅜ of it to his son. What was the value of the remainder at $57⅘ per acre?

48. A post stands $\frac{1}{6}$ in the mud, $\frac{1}{4}$ in the water, and 21 feet above the water; what is its length?

49. A and B together bought 680 sheep. A paid \$9 as often as B paid \$8. How many sheep should each receive?

50. Smith owning $\frac{3}{8}$ of a mill, sold $\frac{2}{5}$ of his share to Brown for \$870. Find the value of the entire mill and Smith's share at present.

51. How many days will be required for A, B and C to do a piece of work, if A can do it in 20 days; B in 30 days; C in 25 days?

52. A and B together can do a piece of work in 4 days. A can do it alone in 6 days. How long will it take B to do it alone?

53. A partnership business realized a profit of \$6160. What was each partner's gain, if A invested $\frac{3}{8}$ of the capital; B, $\frac{5}{11}$; C, the remainder?

54. I sold two horses for \$240. The selling price of one was $\frac{2}{5}$ of the selling price of the other. Find the selling price of each horse.

55. A dealer sold two cows for \$24 each. He lost $\frac{1}{5}$ of the cost on one and gained $\frac{1}{5}$ of the cost of the other. Did he gain or lose and how much by the transaction?

56. A. C. Lamb bought a horse, buggy and harness. The cost of the horse was $1\frac{1}{4}$ the cost of the buggy, and the cost of the harness was $\frac{3}{8}$ the cost of the buggy. What was the cost of each, if the cost of the harness was \$30?

57. A's money is $\frac{4}{5}$ of B's money; B's money is $\frac{5}{6}$ of C's money; C's money is $1\frac{3}{5}$ times D's money. How much money has each, if $\frac{2}{3}$ of A's money is \$64? How much have they together?

58. How many times is $\frac{1}{6}$ of $\frac{4}{9}$ of 27 contained in $\frac{7}{8}$ of $\frac{1}{2}$ of $42\frac{2}{3}$?

59. A and B together own 792 cows; $\frac{2}{5}$ of A's number equals $\frac{3}{4}$ of B's number. How many cows does each own?

60. A father left his eldest son $\frac{3}{7}$ of his estate, his youngest son $\frac{4}{7}$ of the remainder, and his daughter the remainder, who received \$1723$\frac{5}{8}$ less than the youngest son; what was the value of the estate?

DECIMAL FRACTIONS

111. *A Decimal Fraction* is one which has for its denominator 10, 100, 1000, or 1 with any number of ciphers annexed, as $\frac{4}{10}$, $\frac{7}{100}$, $\frac{23}{1000}$.

112. *Common Fractions* arise from dividing a unit into any number of equal parts as *halves, thirds, fifths, etc.*

Decimal fractions arise from dividing a unit into ten equal parts called tenths; each of these parts may be divided again into ten equal parts called hundredths, etc.

113. Since the denominator of a decimal fraction is always 1 with ciphers annexed, it may be expressed by writing the numerator only and using the decimal point to indicate the denominator.

114. *The Decimal Point* is a period (.) which must always be placed at the left of the decimal. It is read "and." Thus 7.4 is read 7 and 4 tenths.

A number containing an integer and decimal is called a *mixed decimal.*

115. Decimal fractions like simple numbers increase in value from right to left and decrease from left to right. The first figure on the right of the decimal point is called *tenths,* the second *hundredths,* the third *thousandths,* etc.

Thus,

$\frac{1}{10}$ is expressed .1 and read one tenth.

$\frac{1}{100}$ is expressed .01 and read one hundredth.

$\frac{1}{1000}$ is expressed .001 and is read one thousandth.

$\frac{125}{1000}$ is expressed .125 and read one hundred twenty-five thousandths.

$100\frac{25}{1000}$ is expressed 100.025 and is read one hundred, *and* twenty-five thousandths.

NOTE.—Decimal fractions are usually called decimals, and common fractions merely fractions.

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The relation of the decimals and integers to each other is clearly shown by the following:

NUMERATION TABLE

Hundred-millions.	Ten-millions.	*Millions.*	Hundred-thousands.	Ten-thousands.	*Thousands,*	Hundreds.	Tens.	UNITS.	Tenths.	Hundredths.	*Thousandths.*	Ten-thousandths.	Hundred-thousandths.	*Millionths.*	Ten-millionths.	Hundred-millionths.
9	8	7	6	5	4	3	2	1.	2	3	4	5	6	7	8	9

INTEGERS   DECIMALS

By examining this table we see that

Tenths	are expressed by one figure.
Hundredths	" " " two figures.
Thousandths	" " " three figures.
Ten thousandths	" " " four figures.

COMPARATIVE VALUES

Common Fraction	Decimal Fraction	Common Fraction	Decimal Fraction
$\frac{1}{2}$	.5	$\frac{1}{7}$	$.14\frac{2}{7}$
$\frac{1}{3}$	$.3\frac{1}{3}$ or $.33\frac{1}{3}$	$\frac{1}{8}$	$.12\frac{1}{2}$ or .125
$\frac{2}{3}$	$.6\frac{2}{3}$ or $.66\frac{2}{3}$	$\frac{2}{8}$	.25
$\frac{1}{4}$	.25	$\frac{3}{8}$	$.37\frac{1}{2}$ or .375
$\frac{2}{4}$	.5 or .50	$\frac{4}{8}$	.50
$\frac{3}{4}$	.75	$\frac{5}{8}$	$.62\frac{1}{2}$ or .625
$\frac{1}{5}$	.2 or .20	$\frac{6}{8}$	.75
$\frac{2}{5}$	.4	$\frac{7}{8}$	$.87\frac{1}{2}$ or .875
$\frac{3}{5}$	.6	$\frac{1}{9}$	$.11\frac{1}{9}$
$\frac{4}{5}$	.8	$\frac{1}{10}$	.1
$\frac{1}{6}$	$.16\frac{2}{3}$	$\frac{1}{12}$	$.08\frac{1}{3}$ or $.0833\frac{1}{3}$
$\frac{2}{6}$	$.33\frac{1}{3}$	$\frac{1}{16}$	$.06\frac{1}{4}$ or .0625
$\frac{3}{6}$	.50	$\frac{1}{20}$	.05
$\frac{4}{6}$	$.66\frac{2}{3}$	$\frac{1}{25}$	.04
$\frac{5}{6}$	$.83\frac{1}{3}$		

From the foregoing we have the following:

To Write Decimals

a. Fix the decimal point.

b. Write the figures so that as many places are occupied at the right of the decimal point as the decimal requires.

NOTE.—In case there are not enough figures to occupy all of the places of the decimals, ciphers must be prefixed to fill up the vacant orders.

Write the following in figures:

1. Nine-tenths.
2. Six-tenths.
3. Four hundredths.
4. Twenty-seven hundredths.
5. Ninety hundredths.
6. Three thousandths.
7. Two hundred sixty-nine thousandths.
8. Two hundred, and sixty-nine thousandths.
9. Two hundred sixty, and nine thousandths.
10. Eight ten-thousandths.
11. Forty-one ten-thousandths.
12. Forty, and one ten-thousandth.
13. Six hundred thirty-four ten-thousandths.
14. Six hundred, and thirty-four ten-thousandths.
15. Six hundred thirty, and four ten-thousandths.
16. Three thousand four ten-thousandths.
17. Nine thousand, and six ten-thousandths.
18. Sixteen hundred thousandths.
19. Eighty-two hundred-thousandths.
20. Eighty, and two hundred thousandths.

To Read Decimals

Read the decimal as a whole number, and then add the name of the right hand order of the decimal.

How many figures are required to express,

1. Tenths?
2. Ten-thousandths?
3. Thousandths?
4. Hundredths?
5. Millionths?
6. Hundred-thousandths?

What is the name of the decimal expressed by

7. Two figures?
8. Four figures?
9. One figure?
10. Three figures?
11. Six figures?
12. Five figures?

Read the following:

13.	.7	20.	.006	27.	.27948	34.	7.9
14.	.04	21.	.207	28.	.00624	35.	9.06
15.	.29	22.	.190	29.	.79250	36.	15.248
16.	.16	23.	.0205	30.	.146003	37.	268.1047
17.	.77	24.	.1628	31.	.020378	38.	100.00001
18.	.019	25.	.9247	32.	.9623479	39.	940.03068
19.	.234	26.	.02045	33.	.1094682	40.	362.006242

REDUCTION OF DECIMALS

116. *Reduction of Decimals* consists in changing their form without altering their value.

117. *To reduce a common fraction to a decimal.*

1. Reduce $\frac{3}{4}$ to a decimal.

SOLUTION

$$\frac{3}{4} = \frac{300}{400} = \frac{75}{100} = .75$$

or,

$$4)3.00$$
$$\overline{.75}$$

We therefore have the following rule:

To Reduce a Common Fraction to a Decimal

a. Annex ciphers to the numerator and divide by the denominator.

b. Point off as many decimal places in the result as there are ciphers annexed to the numerator.

NOTE.—If there continues to be a remainder and the division will not end, the result is called a *repeating decimal,* and the number repeated is called a *repetend.*

2. Reduce $\frac{3}{5}$ to a decimal.

3. Reduce $\frac{5}{8}$ to a decimal.

4. Reduce $\frac{7}{8}$ to a decimal.

5. Reduce $\frac{15}{16}$ to a decimal.

6. Reduce $\frac{5}{24}$ to a decimal.

7. Reduce $\frac{13}{40}$ to a decimal.

8. Reduce $\frac{3}{56}$ to a decimal.

9. Reduce $\frac{9}{84}$ to a decimal.

10. Reduce $\frac{26}{360}$ to a decimal.

11. Reduce $\frac{1}{125}$ to a decimal.

12. Reduce $\frac{3}{800}$ to a decimal.

13. Reduce $12\frac{3}{8}$ to a mixed decimal.

14. Reduce $42\frac{3}{16}$ to a mixed decimal.

15. Reduce $200\frac{3}{200}$ to a mixed decimal.

118. *To reduce a decimal to a common fraction.*

1. Reduce .25 to a common fraction.

SOLUTION

$.25 = \frac{25}{100} = \frac{1}{4}$

We may give the following rule:

To Reduce Decimals to Common Fractions

a. Omit the decimal point, and express the denominator of the fraction.

b. Reduce the fraction to its lowest terms.

2. Reduce .5 to a common fraction.

3. Reduce .45 to a common fraction.

4. Reduce .125 to a common fraction.

5. Reduce .375 to a common fraction.

6. Reduce .016 to a common fraction.

7. Reduce .075 to a common fraction.

8. Reduce .625 to a common fraction.

9. Reduce .9375 to a common fraction.

10. Reduce .0008 to a common fraction.

11. Reduce 28.0625 to a mixed number.

12. Reduce 136.005 to a mixed number.

13. Reduce $.44\frac{4}{9}$ to a common fraction.

14. Reduce $.142857\frac{1}{7}$ to a common fraction.

15. Reduce $.0833\frac{1}{3}$ to a common fraction.

16. Reduce $.0053\frac{4}{7}$ to an equivalent common fraction.

17. Reduce $107.166\frac{2}{3}$ to an equivalent mixed number.

18. Reduce $8.123\frac{2}{7}$ to an equivalent mixed number.

19. What mixed number is the equivalent of $16.0483\frac{1}{3}$?

20. What mixed number is the equivalent of $143.42\frac{13}{21}$?

ADDITION OF DECIMALS

119. *1.* Find the sum of 13.25, .637, 142.6, .085 and 4.2631.

SOLUTION

```
 13.25
   .637
142.6
   .085
  4.2631
260.8351
```

From the foregoing we have the following:

To Add Decimals

a. Write the numbers so that figures of the same order are in the same column, with the decimal points in a column.

b. Add the same as in whole numbers and place the decimal point in the result directly under the decimal points above.

Find the sum of each of the following:

(2)	(3)	(4)	(5)	(6)	
.1625 +	.2314 +	.1847 +	5.6 +	12.70	= x
.3284 +	.3162 +	.3426 +	.853 +	7.28	= x
.2341 +	.3456 +	2.561 +	17.928 +	.785	= x
.3213 +	.2125 +	4.125 +	.0035 +	3.	= x
.4234 +	.4213 +	5.207 +	21.15 +	.095	= x
x +	x +	x +	x +	x	= x

7. 21.75, 8.9, 148.273 and 269.412.

8. 328.013, 93.6, 80.003 and 964.24.

9. 4.5, 49.65, 146.234 and 9268.1726.

10. 200.002, 920.046, 76.36 and .95.1074.

11. 1260.9, 5394.08, 675.149 and 260.024.

12. Add thirty-seven, and three hundredths; five hundred twenty-one thousandths; nine-tenths; one thousand; four thousand, and four ten-thousandths.

13. What is the sum of twenty-six, and twenty-six hundredths; seven-tenths; six, and eighty-three thousandths; four, and four-thousandths?

14. What is the sum of twenty-eight, and seven-tenths; one hundred forty, and sixteen thousandths; thirty-seven ten-thousandths; twenty-five, and fifteen hundred-thousandths; four, and eight hundredths?

15. How many yards in four pieces of cloth, the first containing 28.375 yards; the second 26.4635 yards; the third 14.05 yards, and the fourth 18.2 yards?

16. A boy paid $8.40 for a coat, $3.65 for a vest, $6.152 for a pair of pants, $4 for a hat and $2.857 for a pair of shoes. What sum did he pay for all?

17. A farmer received $478.285 for wheat, $362.675 for oats, $140 for rye, $360.90 for corn and $200 for barley. How much did he receive for all?

18. My farm consists of 7 fields, containing $12\frac{3}{4}$ acres, $18\frac{2}{5}$ acres, 9 acres, $24\frac{1}{8}$ acres, $4\frac{13}{16}$ acres, $8\frac{9}{10}$ acres, and $15\frac{13}{20}$ acres respectively. How many acres in my farm?

Note.—Reduce the common fractions to decimals before adding.

19. A farmer sold $84\frac{1}{2}$ bushels of wheat; $136\frac{3}{4}$ bushels of oats; $122\frac{5}{8}$ bushels rye; 29.0687 bushels of barley; and 548.365 bushels of corn. How many bushels of grain did he sell in all?

20. A merchant sold $3\frac{1}{4}$ yards of cloth for $4.675; 2.5 yards of another piece for $1\frac{7}{8}$; $11\frac{3}{4}$ yards of another piece for $6\frac{3}{4}$; and $5\frac{1}{16}$ yards of another piece for $4\frac{1}{8}$. How many yards did he sell in all, and for how much?

21. Three hundred four, and thirty-two thousandths miles; eighteen, and two thousand seventy-five hundred-thousandths miles; three, and fifteen ten-thousandths miles; and five thousand eighty-two, and one thousand nineteen hundred-thousandths miles equal what?

22. A farmer owns five tracts of land containing respectively eight hundred seventy-six, and eighteen thousandths acres; twenty-eight, and seven-tenths acres; four hundred fifty-six, and five hundred six ten-thousandths acres; seventy-two, and thirteen thousandths acres; and nine thousand three hundred twenty-four, and seven hundred sixteen hundred-thousandths acres. How many acres of land did the farmer own?

SUBTRACTION OF DECIMALS

120. *1.* From 36.85 take 25.015.

SOLUTION
36.85
25.015
————
11.835

To Subtract Decimals

a. Write the numbers so that figures of the same order are in the same column, with the decimal points in a column.

b. Subtract as in whole numbers, supposing any vacant places on the right of the decimal to be filled by ciphers, and write the result beneath, with the decimal point immediately under those above.

Subtract each of the following:

(2)	*(3)*	*(4)*	*(5)*	*(6)*
.9685	.7568	12.3061	15.02	$14.05
.7134	.3724	2.1475	7.3481	$ .975

7. From 890.78 take 762.165.

8. From 1162.847 take 968.28.

9. From 9280.175 take 1186.2468.

10. From 95.06 take 17.281.

11. From 190.004 take 75.86.

12. From $126.28 take $98.95.

13. From $2680.105 take $962.189.

14. From 16.084 take 2 ten-thousandths.

15. From nine take nine ten-thousandths.

16. From $43\frac{15}{16}$ take 75 hundredths.

17. From 825 take .825.

18. From $28.16\frac{4}{5}$ take $17\frac{3}{5}$.

19. From $324.185\frac{1}{2}$ take $218.004\frac{1}{4}$.

20. From $128.37\frac{3}{4}$ take $100.001\frac{5}{8}$.

21.

$$3.25 \;+\; 32.25 \;-\; 30.125 \;=\; x.$$
$$1.001 \;+\; .565 \;-\; .5625 \;=\; x.$$
$$.2436 \;+\; 1.04 \;-\; .325155 \;=\; x.$$
$$100.0025 \;+\; 2.51634 \;-\; 70.12 \;=\; x.$$
$$7.05 \;+\; 43.2114 \;-\; 14.171432 \;=\; x.$$
$$x \;+\; x \;-\; x \;=\; x.$$

MULTIPLICATION OF DECIMALS

121. *1.* Multiply .45 by .5.

SOLUTION

$.45 \times .5 = \frac{45}{100} \times \frac{5}{10} = \frac{225}{1000} = .225$

or,

```
  .45
   .5
 ----
 .225
```

Therefore we deduce the following:

To Multiply Decimals

a. Write the numbers and multiply as in simple numbers.

b. Point off in the product as many figures for decimals as there are decimal places in the multiplicand and multiplier.

NOTE.—If the number of figures in the product is less than the number of decimals in the multiplier and multiplicand, prefix ciphers to the product sufficient to make it equal.

2. Multiply 72.18 by .267. *6.* Multiply 2.165 by 2.165.

3. Multiply 1.964 by .1362. *7.* Multiply 96.87 by .2146.

4. Multiply 7.48 by 12.4. *8.* Multiply 140.0165 by 7.37.

5. Multiply 18.95 by 16.47. *9.* Multiply 1260.50 by 3.005.

10. Multiply seven-tenths by seven-hundredths.

11. Multiply 145 by one hundred forty-five thousandths.

12. Multiply sixty-five thousandths by twenty-three ten-thousandths.

13. Multiply one million by one millionth.

14. I sold 127.5 bushels of wheat at $.8725 per bushel. What did I receive for it?

15. Find the result of 145.08 × 3.75 × .003.

16. Bought 28.75 tons of coal at $6.30 per ton, and sold it for $8.125 per ton. How much did I gain?

DIVISION OF DECIMALS

122. *1.* Divide .125 by .5.

SOLUTION

$$.125 \div .5 = \frac{125}{1000} \div \frac{5}{10} = \frac{\overset{25}{\cancel{125}}}{\underset{100}{\cancel{1000}}} \times \frac{\cancel{10}}{\cancel{5}} = \frac{25}{100} = .25$$

or,

$$.5 \overline{)\,.125}$$
$$.25$$

Therefore we have the following:

To Divide Decimals

a. Write the numbers and divide as in integers.

b. Point off as many decimal figures from the right of the quotient as the number of decimal figures in the dividend exceed those in the divisor.

NOTE.—If the dividend contains a less number of decimal places than the divisor, enough ciphers must be added before beginning the operation to make the decimal places in the dividend equal those in the divisor.

2. If there is a remainder after dividing the dividend, annex ciphers and continue the division. The ciphers annexed are decimals of the dividend.

2. Divide .675 by .15.   *7.* Divide 53.105 by 247.

3. Divide $17.48 by 3.8.   *8.* Divide 12948 by 1.56.

4. Divide 3.822 feet by .49.   *9.* Divide $4608 by $9.6.

5. Divide .6345 by .027.   *10.* Divide 691.92 by .0372.

6. Divide 2.016 by 24.   *11.* Divide 5312.5 ft. by 12.5 ft.

12. Divide .50328 by .1864.

13. Divide 589745 yards by 27.43 yards.

14. How many times is .7854 contained in 12?

15. What is the result of 9 divided by 450?

16. At $.73 per bushel, how many bushels of corn can I buy for $1058.50?

17. At $22.40 each, how many sewing machines can be bought for $716.80?

18. Divide fifteen, and eight hundred seventy-five thousandths, by twenty-five ten-thousandths.

19. Divide thirty-seven, and five thousand six hundred fourteen ten-thousandths by two hundred eighteen millionths.

20. Divide forty-five, and three-tenths by fifteen thousandths.

REVIEW PROBLEMS

123. *1.* Add twenty-five thousandths; nineteen, and one hundred forty-six ten-thousandths; four-tenths; nine, and twenty-seven hundredths; thirteen, and forty-five millionths; sixty-four, and nine hundredths; sixteen, and three-tenths.

2. What is the sum of $81.003 + 5000.4 + 5.0008 + 73.87563 + 1000 + 25 + 3.000548 + .0315$?

3. A farmer has three fields; the first has 247.125 acres, the second 128.375 acres, and the third 197.5 acres. How many acres has he?

4. Find the sum of $28.45, $92.32, $84.23, $174.125, $262.25, $890.625 and $148.

5. I received from A $168.95, from B $365.70, from C $640.20. I paid D $212.45, E $312.27, and F $126.09. How much had I left?

6. From one hundred twenty-five, take one hundred twenty-five ten-thousandths.

7. What is the difference between one million and one-millionth?

8. Multiply .425 by .23.

9. Multiply 36.005 by 20.007.

10. A merchant bought 7 pieces of muslin of 36.75 yards each at $.065 per yard, 9 pieces of flannel of 42.08 yards each at $.1275 per yard, 15 pieces of drilling of 52.4 yards each at $.092 per yard. What was the cost of all?

11. Divide .275 by 800.

12. Divide 1.652 by .236.

13. Divide 2.39015 by .007.

14. If flour is worth $6.475 per barrel, how many barrels can be bought for $692.825?

15. Reduce .875 to a common fraction.

16. Reduce 146.0625 to a mixed number.

17. Reduce $\frac{3}{250}$ to a decimal.

18. Reduce $\frac{16\frac{3}{5}}{25\frac{8}{15}}$ to a decimal.

19. A farmer sold 7 loads of grain, each load containing $46\frac{3}{8}$ bushels, at $62\frac{5}{8}$ cents. What did he receive for the entire quantity of grain?

20. How many times will .05 of 17.875 be contained in .25 of $12\frac{3}{8}$?

COMPOUND NUMBERS

124. *A Denominate Number* is a concrete number which expresses a particular kind of quantity; as 3 feet, 5 pounds.

125. *A Compound Denominate Number* is one which expresses a quantity in different names, but of the same kind, as 3 feet 4 inches; 5 pounds 7 ounces.

All denominate numbers may be embraced under the following divisions: *Value, Weight, Measure and Time.*

126. *Value* is the property of an article which renders it useful.

Value is of three kinds: *Intrinsic, Commercial and Nominal.*

127. *Intrinsic Value* is that which is inherent in the article, usually measured by the labor necessary to produce the article.

128. *Commercial Value* is the value at which an article will exchange for other articles in the markets, or its purchasing power.

129. *Nominal Value* is that which is named or placed upon an article.

In all civilized countries commercial value is measured in *money.*

130. *Money* is a measure of value, and the medium of exchange in business transactions. It usually consists in stamped metals called coin, and printed bills or notes called currency.

UNITED STATES MONEY

131. *United States Money* is the legal currency of the United States. Its denominations increase and decrease upon a decimal scale, ten units of one order making one of the next higher.

The dollar is the unit, and the decimal point or period is used to separate dollars from the cents and mills.

132. *The Coin* of the United States consists of gold, silver, nickel and bronze.

The Gold Coins are the double-eagle, eagle and half-eagle pieces.

The Silver Coins are the dollar, half-dollar, quarter-dollar and ten-cent pieces.

The Nickel Coin is the five-cent piece.

The Bronze Coin is the one-cent piece.

The Paper Money of the United States consists of *United States treasury notes, national bank bills and gold and silver certificates.*

TABLE

10 mills (m.)	make	1 cent..............ct.
10 cents	"	1 dime.............d.
10 dimes	"	1 dollar............$
10 dollars	"	1 eagle............E.

NOTE.—1. The mill is a denomination used only in computations; it is not a coin.

2. The character $ is supposed to be a contraction of U. S. (United States), the U. being placed upon the S.

To Read or Write United States Money

Read or write the number at the left of the period as dollars, the first two figures at the right of the period as cents; and if there be a third figure, as mills.

Read the following:

1. $.16.	*4.* $ 7.35.	*7.* $1000.005.
2. $.09.	*5.* $12.203.	*8.* $ 478.105.
3. $.965.	*6.* $10.10.	*9.* $ 901.0706.

10. Write thirty-nine cents.

11. Write fourteen cents and seven mills.

12. Write ninety-three cents and four mills.

13. Write nine dollars and twenty-five cents.

14. Write one hundred forty-six dollars, four cents and seven mills.

15. Write one hundred dollars, one cent and five mills.

16. Change 375 cents to dollars.

NOTE.—To change cents to dollars point off two places.

17. In 1367 cents how many dollars?

18. In 24367 mills how many dollars?

NOTE.—To change mills to dollars point off three places.

19. Reduce 3428 mills to dollars.

20. In $36 how many cents?

21. In $18.25 how many cents?

22. In 16 cents how many mills?

23. In $235.046 how many mills?

24. In $3.005 how many mills?

ADDITION

133. *1.* What is the sum of 145 dollars 25 cents; 60 dollars 30 cents; 18 dollars 10 cents 5 mills; 340 dollars $37\frac{1}{2}$ cents; and 12 dollars 87 cents 5 mills?

SOLUTION

$145.25
  60.30
  18.105
340.375
  12.875
—————
$576.905

To Add United States Money

a. Write dollars under dollars, cents under cents, etc.

b. Add as in simple numbers and place the point in the amount as in addition of decimals.

2. Find the sum of 180 dollars 15 cents 7 mills; 236 dollars 42 cents 4 mills; 105 dollars 65 cents 3 mills; 118 dollars 50 cents 9 mills; 300 dollars 4 cents 2 mills.

3. Find the sum of 65 cents; 1 dollar 1 cent 1 mill; 100 dollars; 32 dollars 10 cents 1 mill; 18 cents 6 mills; $12\frac{1}{2}$ cents; 85 cents 7 mills.

4. A collector was sent out to collect bills for the following amounts: $128.14; $36.25; 10.67\frac{1}{2}$; $246.34; 1.62\frac{1}{2}$; and $100. What was the total amount to be collected?

5. A lady made purchases as follows: A dress for $16.35; a hat for 9.87\frac{1}{2}$; a pair of shoes for $4.50; a paper of needles for 6 cents; some ribbon for 35 cents. What was the total amount of her purchases?

6. A merchant has due him from one customer $536.84; from another $387.25; from another $200.40; from another $230.75; from another $804.32; and from another 675.62\frac{1}{2}$. What is the total amount due from these six customers?

7. A farmer paid $2867.50 for a farm. He expended $238.60 for fencing it; $860.12 for a house upon it; and $216.30 for other improvements. What was the farm then worth?

8. Bought a horse for $180.65; a buggy for $212.35; a harness for $30.75, and a saddle for $18.60. Find the total cost of the outfit.

9. The annual expenses of a business are, for rent $2000; clerk hire $3250; fuel and light $875.30; advertising $1632.04; insurance $400; repairs $142.80; incidentals $126.34. Find the total expenses of the business for the year.

10. A bought a hat for 4.62\frac{1}{2}$; a pair of shoes for 3\frac{3}{4}$; an umbrella for 1\frac{1}{8}$; a pair of gloves for $.62$\frac{1}{2}$ and a cane for $\frac{7}{8}$. What was the entire cost of his purchases?

11. A student expended for tuition $86.50; for board $138.45; for clothes $46.32; for church and charity $11.48. What amount did he expend in all?

12. A lady bought groceries to the amount of $5.80; meats $3.48; dry goods $26.42; carpets $148.35; millinery 23.62\frac{1}{2}$. What was the total amount of her expenditures?

13. The expenses of a household for one month are: groceries $36.40; meats $18.60; coal $11.30; kindling $2.65; milk $9.80; gas $3.75; servant $4.50; incidentals $13.65. What are the total expenses?

SUBTRACTION

134. *1.* From 123 dollars 75 cents take 84 dollars 42 cents.

SOLUTION

$123.75

  84.42

 $39.33

To Subtract United States Money

a. Write the subtrahend under the minuend, dollars under dollars and cents under cents.

b. Subtract as in simple numbers and place the point in the remainder directly under the point above.

2. From 246 dollars 5 cents take 134 dollars 17 cents.

3. From 100 dollars 1 mill subtract 16 dollars 25 cents 2 mills.

4. From 1000 dollars take 1 cent 1 mill.

5. John Davis owes 1000 dollars 25 cents 4 mills; if he pay 832 dollars 16 cents 7 mills, how much will he still owe?

6. A man bought a farm for $3625.14 and sold it for $4201.70. What did he gain by the operation?

7. Having $6287.35 deposited in a bank I drew out at one time $2436.14 and at another time $900.15. How much had I remaining in the bank?

8. A boy earned $79.15. He spent $18.40 for clothes, and $9.85 for books. How much had he left?

9. A merchant in one week sold $1160 worth of goods, and paid of that sum $170 for rent, $86 for light, $140 for clerk hire. How much had he left?

10. A gentleman paid for a lot $1650, and for a house $2000 more than the lot cost him. He then sold both house and lot for $4627.35. What did he gain or lose by the transaction?

11. A grocer sold to a customer, coffee amounting to $1¾; tea $2¾; sugar $.62½; rice $.33; crackers $¼; cheese $.90; barrel of salt $1.35. He received in payment a ten-dollar bill. How much change should he return to the customer?

MULTIPLICATION

135. *1.* If one yard of cloth cost $3.625 what will 15 yards cost?

SOLUTION

$3.625
15
─────
18125
3625
─────
$54.375

To Multiply United States Money

a. Multiply as in simple numbers and point off the product as in multiplication of decimals.

2. If one barrel of flour cost $6.75 what will 27 barrels cost?

3. At $34.25 apiece what must be paid for 17 cows?

4. A speculator bought a farm of 160 acres at $45.25 per acre. What did the farm cost?

5. A merchant sold the following bill of goods: 9 pounds of tea at 56 cents a pound; 6 pounds of butter at 35 cents a pound; 8 pounds of coffee at 31 cents a pound; 7 gallons of molasses at 75 cents a gallon. What did the whole amount to?

6. A farmer sold 125 bushels of wheat at $87\frac{1}{2}$ cents per bushel; 243 bushels of oats at $37\frac{1}{2}$ cents per bushel; 584 bushels of corn at $\$\frac{5}{8}$ per bushel and 48 bushels of clover seed at $1.65 per bushel. He received in payment a note for $200; and the balance in money. How much money did he receive?

7. Joseph Brown bought a fruit farm consisting of 35 acres for $6340. He sold 21 acres of it for $5216.87\frac{1}{2}$ and the balance at $215.35 per acre. What did he gain?

8. A merchant bought 325 barrels of flour at $6.75 per barrel. He sold 210 barrels at $7.12\frac{1}{2}$ per barrel and the remainder at $6.62\frac{1}{2}$ per barrel. How much did he gain or lose in the operation?

DIVISION

136. *1.* If 27 yards of cloth cost $9.45, what will one yard cost?

 SOLUTION
27)$9.45(.35
  81
  ‾‾‾
  135
  135
  ‾‾‾

To Divide United States Money

a. Divide as in simple numbers and point off the quotient as in division of decimals.

NOTE.—If the dividend will not contain the divisor an exact number of times, ciphers may be annexed, and the division continued as in decimals.

 2. If 16 pounds of tea cost $8.96 what will one pound cost?

 3. If 25 acres of land cost $1125, what will 1 acre cost?

 4. If 36 yards of broadcloth cost $139.50, what will one yard cost?

 5. If 45 pounds of butter cost $14.40 what will be the cost of 1 pound?

 6. How many barrels of apples can be bought for $534.37½ at the price of $1⅛ per barrel?

 7. A man earns $864 in a year. How much is that a month?

 8. If 100 acres of land cost $5637.50, what will one acre cost?

 9. If 265 pounds of lard cost $34.45, what will one pound cost?

 10. A farmer exchanged 235 bushels of corn at 45 cents a bushel for buckwheat at 85 cents a bushel. How many bushels of the latter did he receive?

 11. A young man's board for one year is $318⅔. How much is it per day?

 12. A grocer bought 18 kegs of butter of 25 pounds each for $121.50. How much was that per pound?

 13. If 16 men receive $516 for 43 days' work, how much does each man earn a day?

 14. C earned $90 in 40 days, working 10 hours a day; how much did he earn an hour?

SHORT METHODS

137. *An Aliquot Part* of a number is one which will exactly divide it. Thus 5, 10 and 20 are aliquot parts of 60; $12\frac{1}{2}$ of 100, etc.

Aliquot Parts of One Dollar

50 cents $= \frac{1}{2}$ of \$1.	$8\frac{1}{3}$ cents $= \frac{1}{12}$ of \$1.
$33\frac{1}{3}$ cents $= \frac{1}{3}$ of \$1.	$6\frac{1}{4}$ cents $= \frac{1}{16}$ of \$1.
25 cents $= \frac{1}{4}$ of \$1.	5 cents $= \frac{1}{20}$ of \$1.
20 cents $= \frac{1}{5}$ of \$1.	$37\frac{1}{2}$ cents $= \frac{3}{8}$ of \$1.
$16\frac{2}{3}$ cents $= \frac{1}{6}$ of \$1.	$62\frac{1}{2}$ cents $= \frac{5}{8}$ of \$1.
$12\frac{1}{2}$ cents $= \frac{1}{8}$ of \$1.	$87\frac{1}{2}$ cents $= \frac{7}{8}$ of \$1.
10 cents $= \frac{1}{10}$ of \$1.	$83\frac{1}{3}$ cents $= \frac{5}{6}$ of \$1.

Multiplication Table

	$2\frac{1}{2}$	$3\frac{1}{3}$	$6\frac{1}{4}$	$8\frac{1}{3}$	$12\frac{1}{2}$	$16\frac{2}{3}$
1	$2\frac{1}{2}$	$3\frac{1}{3}$	$6\frac{1}{4}$	$8\frac{1}{3}$	$12\frac{1}{2}$	$16\frac{2}{3}$
2	5	$6\frac{2}{3}$	$12\frac{1}{2}$	$16\frac{2}{3}$	25	$33\frac{1}{3}$
3	$7\frac{1}{2}$	10	$18\frac{3}{4}$	25	$37\frac{1}{2}$	50
4	10	$13\frac{1}{3}$	25	$33\frac{1}{3}$	50	$66\frac{2}{3}$
5	$12\frac{1}{2}$	$16\frac{2}{3}$	$31\frac{1}{4}$	$41\frac{2}{3}$	$62\frac{1}{2}$	$83\frac{1}{3}$
6	15	20	$37\frac{1}{2}$	50	75	100
7	$17\frac{1}{2}$	$23\frac{1}{3}$	$43\frac{3}{4}$	$58\frac{1}{3}$	$87\frac{1}{2}$	$116\frac{2}{3}$
8	20	$26\frac{2}{3}$	50	$66\frac{2}{3}$	100	$133\frac{1}{3}$
9	$22\frac{1}{2}$	30	$56\frac{1}{4}$	75	$112\frac{1}{2}$	150
10	25	$33\frac{1}{3}$	$62\frac{1}{2}$	$83\frac{1}{3}$	125	$166\frac{2}{3}$

NOTES.—1. This table can be easily learned and will prove convenient in mental operations.

2. Black figures indicate multipliers and multiplicands. Intersecting points of horizontal and vertical columns give the products.

Count by $2\frac{1}{2}$ to 100; as, $2\frac{1}{2}$, 5, $7\frac{1}{2}$, etc.

Count by $12\frac{1}{2}$ to 100, return by subtracting 10's.   ·

Count by $3\frac{1}{3}$ to 100, return by subtracting 5's.

Count by $16\frac{2}{3}$ to 100, return by subtracting $12\frac{1}{2}$'s.

138. *To find the cost of a quantity when the price is an aliquot part of $1.*

1. Find the cost of 48 pounds of butter at 25 cents a pound.

SOLUTION   EXPLANATION.—At $1 a pound 48 pounds would cost $48,
4) 48   but 25 cents is ¼ of a dollar, and hence the whole cost will

$12   be ¼ of $48 or $12.

From this solution we have the following:

To Find the Cost When the Price Is an Aliquot Part of $1

a. Take such part of the given quantity as the price is part of one dollar.

2. What cost 218 gallons of syrup at 50c per gallon?

3. What cost 468 yards of cloth at $33\frac{1}{3}$ cents per yard?

4. What cost 1250 pounds of lard at $12\frac{1}{2}$ cents per pound?

5. What cost 564 dozen eggs at $16\frac{2}{3}$ cents per dozen?

6. What cost 26840 yards of calico at $8\frac{1}{3}$ cents per yard?

7. Find the cost of 2435 pounds of pork at $6\frac{1}{4}$ cents per pound.

8. What cost 486 cans of peaches at 20 cents per can?

9. What cost $214\frac{1}{2}$ quarts of berries at 5 cents per quart?

10. At $16\frac{2}{3}$ cents per yard, what cost 26480 yards of linen?

139. *To find the quantity when the price is an aliquot part of $1.*

1. If cloth costs $33\frac{1}{3}$ cents per yard, how many yards can be bought for $29?

SOLUTION

At $33\frac{1}{3}$c per yard $1 will buy 3 yards.

$29 will buy 3 × 29 or 87 yards.

To Find the Quantity When the Price Is an Aliquot Part of $1

a. Multiply the cost by the quantity that can be bought for one dollar.

2. If one pound of butter cost 25 cents, how many pounds can be bought for $13.25?

3. At $16\frac{2}{3}$ cents a dozen, how many dozen eggs can be bought for \$32.15?

4. A gardener exchanged potatoes worth $66\frac{2}{3}$ cents per bushel for 5 barrels of flour worth \$6.75 per barrel. How many bushels of potatoes did he give?

5. A farmer sold 15 bushels of buckwheat at $87\frac{1}{2}$ cents per bushel and received in pay pork at $6\frac{1}{4}$ cents per pound. How many pounds did he receive?

6. John Wilson expended \$3625 in the purchase of a farm at \$50 per acre. How many acres did he buy?

7. I exchange 275 feet of city land worth \$75 per foot, for farming land worth $\$66\frac{2}{3}$ per acre. How many acres do I receive?

8. A grocer expended \$32.50 for A sugar worth $6\frac{1}{4}$ cents per pound, and \$48.75 for C sugar at 5 cents per pound. How many pounds of sugar did he buy?

140.   *To find the cost of articles sold by the 100 or 1000.*

Note.—C stands for 100. M stands for 1000.

1. What is the cost of 1850 feet of lumber at \$3.20 per C?

SOLUTION
1850 feet = 18.50 C feet.
$18.50 \times \$3.20 = \$59.20$.

Therefore we may deduce the following rule:

To Find the Cost of Articles Sold by the C or M

a. Reduce the quantity to hundreds and decimals of a hundred or thousands and decimals of a thousand.

b. Multiply by the price per C or per M and point off as in multiplication of decimals.

Note.—Use aliquot parts where practicable.

2. Find the cost of 1645 pounds of beef at \$4.60 per C.

3. Find the cost of 4267 pounds of scrap iron at \$5.30 per C.

4. What is the freight from New York to Chicago on 6238 pounds of merchandise at $\$1.62\frac{1}{2}$ per C?

5. What will be the cost of 2632 feet of pine boards at $18.50 per M?

6. What cost 6428 bricks at $6.50 per M?

7. What will be the cost of 1625 feet of oak lumber at $35 per M?

8. Find the cost of 384 ax handles at $11.50 per C.

9. Find the cost of 8425 shingles at $7.30 per M.

10. A printer printed 11267 envelopes at $2.15 per M. What did he receive for the job?

11. In repairing a house I used 2610 bricks at $5.80 per M; 2180 feet of boards at $13 per M; 167 feet of scantling at $9.80 per M; 1280 pounds of nails at 20 cents per C. What was the total cost?

141. *To find the cost of articles sold by the ton of 2000 pounds.*

1. What will 4360 pounds of coal cost at $7.50 per ton?

SOLUTION

$7.50 = cost of 1 ton or 2000 lb.
$3.75 = cost of ½ ton or 1000 lb.
4360 lb. = 4.360 thousand weight.
4.36 × $3.75 = $16.35.

To Find the Cost of Articles Sold by the Ton of 2000 Pounds

a. Divide the price of 1 ton by 2 and the quotient will be the price of 1000 pounds.

b. Reduce the pounds to thousands and decimals of a thousand by pointing off three places.

c. Multiply the price per thousand by the number of thousands and decimals of a thousand.

2. At $18.50 per ton what will 6342 pounds of hay cost?

3. At $22.50 per ton what will 468 pounds of hay cost?

4. At $3.25 per ton what will 1685 pounds of soft coal cost?

5. At $7.80 per ton what will 2632 pounds of hard coal cost?

6. At $49.50 per ton what will be the cost of 42367 pounds of steel rails?

7. At $28.60 per ton what will be the cost of 26420 pounds of pig iron?

8. At $5.80 per ton what will be the cost of a cargo consisting of 48625 pounds of salt?

9. Bought 48 sacks of land plaster, each sack weighing 180 pounds at $23 per ton. What was the cost?

10. What will be the freight at $6.25 per ton on five invoices of merchandise weighing as follows: 2436 pounds, 1972 pounds, 4837 pounds, 4265 pounds and 3428 pounds?

BILLS

142. A *Bill* is a detailed account of goods sold or services rendered, giving the price of each article and the cost of the whole.

The bill is said to be "receipted" when the words "Received Payment" or "Paid" are written near the bottom with the signature of the seller. The bill is then a receipt for the amount paid.

143. An *Invoice* differs in no respect from a bill. The term is usually applied to goods bought in large quantities.

144. A *Statement* is an account of bills rendered, usually during the previous month, and give the date of each bill with its total amount.

145. Find the cost of the several articles and the total amount of each of the following bills:

In billing it is customary to count 1c extra where the computation produces 5 mills or more, when less than 5 mills the mills are dropped. The result is shown in dollars and cents.

Find the total cost of:

1. 412 yds. at 25c.	2. 34 yds. at 10c.	3. 25 lbs. at $6\frac{1}{4}$c.
360 yds. at 20c.	64 yds. at 5c.	36 lbs. at $12\frac{1}{2}$c.
420 yds. at $12\frac{1}{2}$c.	75 yds. at $2\frac{1}{2}$c.	60 lbs. at $18\frac{3}{4}$c.
350 yds. at 50c.	46 yds. at $12\frac{1}{2}$c.	56 lbs. at 25c.
324 yds. at 11c.	40 yds at $6\frac{1}{4}$c.	72 lbs. at $31\frac{1}{4}$c.
4. $36\frac{1}{2}$ yds. at 20c.	5. 125 yds. at $31\frac{1}{4}$c.	6. 72 lbs. at 12c.
75 yds. at $12\frac{1}{2}$c.	324 yds. at $62\frac{1}{2}$c.	84 lbs. at 14c.
84 yds. at $6\frac{1}{4}$c.	136 yds. at $87\frac{1}{2}$c.	96 lbs. at 16c.
36 yds. at 25c.	260 yds. at $56\frac{1}{4}$c.	87 lbs. at 22c.
90 yds. at $31\frac{1}{4}$c.	320 yds. at $1.25.	92 lbs. at 11c.

7. 25 pieces of gingham: 36[1], 37, 33[2], 34, 36[2], 38[1], 34, 39[3], 42[2], 41, 40, 41[1], 42, 41[1], 43, 46[2], 42[1], 39[3], 38, 36[2], 37, 39[3]. 41, 42[1], 43 at $12\frac{1}{2}$c per yard.

(8)

New York, August 15, 1905.

Mr. William Sampson,

Bought of Davis & Johnston.

4	lbs.	Tea..........	@ .50	$*.**
5	"	Butter.......	@ .32	*.**
9	"	Bacon.......	@ .12½	*.**
10	"	Lard.........	@ .09	.**
4	"	Raisins......	@ .22	.**
3	doz.	Eggs........	@ .18	.**
				$*.**

Received Payment,

Davis & Johnston.

(9)

Chicago, January 7, 1905.

Messrs. B. M. Smith & Co.,

Bought of Finlay & Holmes.

8	yds.	Silk...................	@	$1.12½
15	"	Muslin................	@	.15
25	"	Linen.................	@	.08⅓
12	"	Calico................	@	.18
6	"	Gingham...............	@	.42
				$**.**

Received Payment,

Finlay & Holmes.

(10)

San Francisco, March 14, 1905.

Wm. Duncan,

Bought of Malzen Bros.

8	prs.	Men's Thick Boots...	@	$3.25
6	"	Kip Plow Shoes......	@	2.87½
4	"	Boys' Calf Boots....	@	1.75
11	"	Cloth Gaiters.......	@	2.35
6	"	Ladies' Slippers....	@	1.60
4	"	Rubbers.............	@	.87½
				$**.**

Received payment by note 60 days,

Malzen Bros.

(11)

New Orleans, May 15, 1905.

Messrs. Daniel C. Hartwell & Co.,

Bought of A. Carter & Co.

1640	ft.	A Flooring.....	@ $24		per M.
920	"	C Flooring......	@	18	"
2467	"	Fencing.........	@	16	"
5428	"	Scantling.......	@	13	"
1432	"	Timber.........	@	9.37½	"
860	"	Timber.........	@	8.62½	"

$$\$**.**$$

Received payment,
A. Carter & Co.
Per Davis.

(12)

Cleveland, Ohio, June 10, 1905.

Mr. J. A. Lyons,

Bought of Collins, Holbrook & Co.

35	lbs.	Coffee Sugar..................	@ $	.04
15	"	Granulated Sugar..............	@	.05½
7	"	Y. H. Tea...........	@	.48
30¼	gal.	Molasses.....................	@	.70
18	lbs.	Prunes.......................	@	.06¼
3	boxes	Raisins......	@	1.65
25	lbs.	Spice.........................	@	.15½
10	"	White Glue...................	@	.40

$$\$**.**$$

Received Payment,
Collins, Holbrook & Co.

(13)

CHICAGO, ILL., June 10, 1903.

MR. J. P. SHOW,

Bought of HOMER K. GOLPIN.

5 bbls. A. C. Sugar

316	320	324	330	328
26	24	29	32	30 @ $5.50

5 bbls. Granulated Sugar

312	316	310	314	311
24	20	21	23	20 @ $5.75

4 bbls. Loaf Sugar

275	284	290	287	
18	20	22	21	@ $5.80

(14)

MILWAUKEE, WIS., June 11, 1903.

MESSRS. D. C. MEYER & CO.,

Bought of JONES & LAUGHLIN.

20 pc. Gingham

34^1, 33, 32^2, 36^1, 37^1, 38^2, 31^3, 32^1, 34, 35^1,

36, 34^1, 29^3, 43^2, 44, 41^1, 40^3, 46, 32^2, 39^1 @ $18\frac{3}{4}$

18 pc. do.

41^1, 42^2, 40^3, 43, 41^1, 38, 36^3, 39^2, 37^1,

40^1, 41^2, 38, 41^3, 47^2, 39^1, 42, 43^2, 41 @ $16\frac{1}{2}$

(15)

PAY ROLL PROBLEM

Names	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	No. of hours	Per hour	Due
R. G. Anderson	8	8	9	9	9	5	....	.45	
G. W. Bridges	9	9	8	8	8	5	....	.40	
G. J. Buechele	8	8	8	8	8	5	....	$.47\frac{1}{2}$	
B. Bullwinkle	8	8	9	10	10	5	....	.25	
H. R. Bonnes	7	7	8	8	10	5	....	$.27\frac{1}{2}$	
L. Berkson	7	6	6	Discharged.			....	.30	
B. L. Blose	10	10	8	7	6	4	....	$.32\frac{1}{2}$	
A. L. Beck	8	8	S	S	8	4	....	$.37\frac{1}{2}$	
A. L. Counzelman	6	6	8	9	6	3	....	.40	
W. F. Carpenter	5	4	4	4	4	3	....	.50	
C. M. Deshlie	8	9	8	8	6	5	..▲.	$.52\frac{1}{2}$	
R. E. Fisher	10	10	10	9	8	5	....	$.47\frac{1}{2}$	

Half pay when out sick or disabled.   Find amount of money
necessary to pay off help.

(16)

PAY ROLL PROBLEM

Names	Mon.	Tues	Wed.	Thurs.	Fri.	Sat.	No. of hours	Day's pay	Pay due
Fahlsing, O. F.	10	10	10	10	10	10	60	3.	18.
Gearghty, J. R.	9	9	10	10	10	10	....	3.	....
Goodfellow, Jos.	8	8	9	9	9	9	....	4.	....
Gregoldt, G. J.	7	8	6	5	10	10	....	4.	....
Grey, G. O.	5	5	5	5	5	5	....	5.	....
Hunt, J. C.	5	4	4	5	6	6	....	3.	....
Joyce, M. J.	8	8	8	8	8	8	....	2.	....
Koellner, C. A.	7	7	6	8	9	9	....	2.	....
LaRue, F. L.	10	10	10	8	8	9	....	3.50	....
Moore, J. P.	9	8	7	5	0	0	....	2.50	....
Miller, H. W.	8	0	0	5	10	10	....	4.50	....
Perring, W. A.	9	9	9	10	10	10	....	3.25	....

In the above pay roll report 10 hours is to count a day. To
avoid fractions in computation, multiply the number of hours by
the pay and divide by the number of hours counted as a day's
work.   When full time has been made multiply the number of
days by the daily pay.   Find amount of money necessary to pay
off help.

REVIEW PROBLEMS

146. *1.* A merchant owes to one man $146.25, to another
$38.62½, to another $367.80, to another $16.40, and to another
$54.30.   What amount does he owe?

2. What will be the cost of 56 barrels of flour at $7.25 per
barrel?

3. If 16.15 tons of railroad iron cost $730.78¾, what will one
ton cost?

4. I owe A $267.35, B $145.39, and C as much as A and B
and $16 more.   How much do I owe to all?

5. Jones collected $1624, and Davis collected .65 of that
amount.   How much did they both collect?

6. A clerk earns $50 a month.   He spends $23.50 for his

board and $8.15 for other expenses. How much will he save in one year?

7. A farmer sold 132.51 bushels of corn for $44.17. How much did he receive per bushel?

8. A lady went shopping with $50. She bought a cloak for $32, 3 yards of silk at $2.12½ a yard, 5 yards of cambric at $.15 a yard and 3 dozen buttons at $.18. How much money had she remaining?

9. Bought a horse for $165, a yoke of oxen for $95, 4 cows at $32 each, and sold them all for $400. How much did I gain or lose by the transaction?

10. A man bought 4¾ tons of hay for $48.30¾. How much was that per ton?

11. I owe A $185.47; B $346.87; C $287.36; D $418.25; E $29.50; and F $125.75. I own property worth $1265.40. How much do I owe more than I am able to pay?

12. Bought 640 bushels of wheat at 85 cents per bushel. After paying $185.60 what remained yet unpaid?

13. A laborer earns $1.75 a day and spends $1.62½ a day. How much can he save in one year of 313 working days?

14. A farmer owed $800. He paid 265 bushels of corn worth 45 cents per bushel and 400 bushels of wheat worth 87½ cents per bushel. How much is still unpaid?

15. A merchant deposited in bank at one time $1725; at another $867.50; at another $584.30. He then drew out $738.40, and again deposited $628.42. How much had he then in the bank?

16. A banker's expenses are $8.75 a day. How much will he save in 365 days, his income being $4000?

17. Bought 486 barrels of apples for $1579½. Sold one-half of them at cost price and the remainder at $3.75 per barrel. How much did I receive for them?

18. A crop of wheat amounting to 3420 bushels was sold for $1881. How much was that per bushel?

19. Bought 165 barrels of apples of 3 bushels each at 35 cents per bushel and sold the whole for $200. How much did I gain?

20. A drover bought cattle at $46.56 per head, and sold them at $65.42 per head, and thereby gained $3526.82. How many cattle did he buy?

21. If 26 men receive $988 for 38 days' work, how much does each man earn a day?

22. A gentleman dying left one-third of his estate amounting to $48000 to his widow and the remainder to his six children equally. What was the portion of each child?

23. If 25 men perform a piece of work for $2000, and spend, while doing it, $163.75, what will be each man's share of the profits?

24. What is the cost of 24865 pounds of hay at $23.50 per ton?

25. A grocer bought a hogshead of molasses containing 63 gallons for $49.14; 9 gallons leaked out and he sold the remainder at 85 cents per gallon. Did he gain or lose on the entire quantity, and how much?

26. If $5\frac{5}{8}$ barrels of flour cost $28\frac{3}{5}$ what will $13\frac{3}{4}$ barrels cost?

27. What is the cost of seven pieces of cambric, each piece containing 23 yards at $12\frac{1}{2}$ cents per yard?

28. Reduce $\dfrac{2\frac{3}{4}}{5\frac{6}{12}}$ to a decimal fraction.

29. What cost 1827 pounds of fertilizer at $32.40 per ton?

30. John runs 45 rods a minute and William pursues him at the rate of 50 rods a minute. If John has 5 minutes the start of William, how long will it require William to overtake John?

31. Reduce .0625 to a common fraction.

32. What is the cost of 14620 bricks at $5.60 per M?

33. What will $\frac{875}{1000}$ of a cord of wood cost at $5.65 per cord?

34. Reduce $\frac{3}{32}$, .$62\frac{1}{2}$, .$37\frac{1}{16}$, $\frac{3}{8}$ to decimals, and find their sum.

35. A miller bought $356\frac{3}{4}$ bushels of wheat of one man and 145 of another at $62\frac{1}{2}$ cents per bushel. He sold $\frac{2}{3}$ of the entire quantity at a profit of $52.80, and the balance at $68\frac{1}{2}$ cents per bushel. How much did he gain or lose by the transaction?

36. Find the number of gallons in 5 barrels of cider if the first contained 31.375 gallons, the second 38.0002 gallons, the

third 34.4 gallons, the fourth 36.12 gallons, and the fifth 35 gallons.

37. A man bequeathed .125 of his property to an orphan asylum, $\frac{5}{16}$ to his son, and the remainder, which was $24120, to his wife. What was the value of his property?

38. A dealer's sales of carpeting and matting for a year were $264320, and the sales of matting were .1875 of the total sales. The cost of the carpeting was .75 of its sales, and the total expenses of the business were .15625 of the cost of the carpeting. What were the sales of the matting? Of the carpeting? What was the cost of the carpeting? What were the total expenses?

REDUCTION OF DENOMINATE NUMBERS

147. *Reduction* is the process of changing a number from one denomination to another without altering its value.

148. *Reduction Descending* is changing a number from a higher to a lower denomination. Thus, 1 foot changed to 12 inches.

149. *Reduction Ascending* is changing a number from a lower to a higher denomination. Thus, 16 ounces changed to 1 pound.

VALUE

150.   **1. United States Money**

TABLE

10 mills (m.) make		1 cent............ct.
10 cents	"	1 dime...........d.
10 dimes	"	1 dollar..........$
10 dollars	"	1 eagle ....E.

151. *A Legal Tender* is money which, if offered, legally will save the debtor from further interest and from costs of suit.

NOTES.—1. All the *gold* coins, and the *silver* coins of $1 and upwards, except the trade dollar, are legal tender for all payments.

2. Silver coins *less* than $1 are legal tender to the amount of $10; nickel and bronze pieces to the amount of 25 cents.

II. Canada Money

152. *Canada Money* is the *legal currency* of the Dominion of Canada. It is founded on the Decimal Notation, and its denominations, *Dollars, Cents* and *Mills*, have the same nominal value as the corresponding denominations of United States money. Hence, all the *operations* in it are the same as those in United States money.

III. English Money

153. *English Money* is the currency of Great Britain.
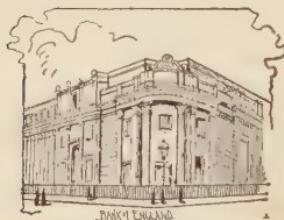
4 farthings (far.) make 1 penny........d.
12 pence   "   1 shilling......s.
20 shillings   "   1 pound or sov..£

NOTES.—1. The *gold coins* are the sovereign (= £1), and the half-sovereign.

2. The *silver coins* are the crown (= 5s.), the half-crown (= 2s. 6d.), the florin, the shilling, and the six-penny, four-penny and three-penny pieces.

3. The *copper coins* are the penny, halfpenny and farthing.

4. The guinea (= 21s.) and the half-guinea (= 10s. 6d. sterling), are old gold coins, and are no longer coined.

Money Equivalents

1 pound	English	$4.8665
1 shilling	do	.$24\frac{1}{3}$
1 crown	Austria	.203
1 mark	Germany	.238
1 franc	France	.193
1 lira	Italy	.193
1 ruble	Russia	.772

154. *To perform reduction descending.*

1. Reduce £3 8s. 10d. 3 far. to farthings.

SOLUTION

£3 8s. 10d. 3 far.
  20
 ‾‾‾‾
 68s.
 12
‾‾‾‾‾
826d.
  4
‾‾‾‾‾‾
3307 far.

From the foregoing we have the following rule for

Reduction Descending

a. Multiply the highest denomination by that number which will reduce it to the next lower and add the given number of that denomination, if any.

b. Proceed in the same manner with the results obtained in each denomination until the whole is reduced.

155. *To perform reduction ascending.*

2. Reduce 3307 farthings to pounds.

SOLUTION

4)3307 far.
12) 826d. + 3 far.
20) 68s + 10d.
    £3 + 8s.
    £3 8s. 10d. 3 far.

From the foregoing we have the following rule for

Reduction Ascending

a. Divide the given number by that number which will reduce it to the next higher denomination.

b. Divide the quotient by the next higher number in the same manner; and so proceed to the highest denomination required. The last quotient, with the several remainders will be the answer.

NOTE.—Reduction descending and reduction ascending mutually prove each other.

3. Reduce £23 9s. 8d. 3 far. to farthings.
4. Reduce 7868d. to higher denominations.
5. Reduce £10 9s. 6d. 2 far. to farthings.
6. Reduce 5s. 3d. 1 far. to farthings.
7. In 17852 far. how many pounds?
8. In £83 6s. 3 far. how many farthings?
9. In 1624d. how many pounds?
10. In £1428 how many pence?

WEIGHT

156. *Weight* is the measure of the force of gravity which draws all bodies towards the center of the earth.

The standard of weight in the United States is the troy pound.

157. There are three kinds of weights used in the United States, viz.: *Avoirdupois, Troy* and *Apothecaries.*

I. Avoirdupois Weight

158. *Avoirdupois or Commercial Weight* is used for weighing ordinary articles, such as groceries, farm produce and all metals except the precious metals.
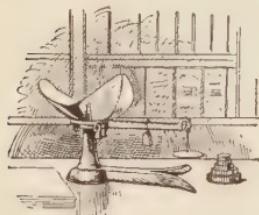
TABLE

16 drams (dr.)	make 1 ounce	............oz.
16 ounces	" 1 pound	............lb.
100 pounds	" 1 hundred-weight,	cwt.
20 cwt., or 2000 lbs.	" 1 ton	..............T.
112 lbs.	= 1 long hundred-weight.	
2240 lbs.	= 1 long ton.	

NOTES.—1. In the United States Custom House and in wholesale transactions in coal and iron, the long ton is used.

2. The avoirdupois pound is determined from the standard troy pound, and contains 7000 troy grains.

Special Avoirdupois Weights

100 pounds of Dry Fish		make 1 Quintal.	
100 "	Nails	" 1 Keg.	
196 "	Flour	" 1 Barrel.	
200 "	Pork or Beef	" 1 Barrel.	
280 "	Salt at N. Y. S. Works	" 1 Barrel.	
240 "	Lime	" 1 Cask.	

159. *Gross Weight* is the weight of the goods together with the box, cask or whatever contains them.

160. *Net Weight* is the weight of the goods alone.

Tare is the allowance made for the weight of the packing.

When grain and seeds are bought and sold by weight so many pounds are considered as a bushel. The following table gives the weights in general use:

TABLE OF POUNDS PER BUSHEL

Commodities	Lbs.	Commodities	Lbs.	Commodities	Lbs.
Barley	48	Corn, Shelled	56	Potatoes	60
Beans............	60	Corn, in Ear	70	Rye..............	56
Buckwheat	48	Flax Seed........	56	Timothy Seed.....	45
Blue Grass Seed..	14	Malt	34	Wheat............	60
Coal, Bituminous.	80	Oats..............	32	Wheat Bran.......	20

NOTE.—See page 352 for weights of other articles.

1. Reduce 3 cwt. 2 lbs. to pounds.

2. Reduce 2 T. 5 cwt. to pounds.

3. Reduce 5 cwt. 15 lbs. 13 oz. to ounces.

4. Reduce 2 cwt. 14 lbs. 3 dr. to drams.

5. Reduce 3 T. 7 cwt. 18 lbs. 11 oz. 14 dr. to drams.

6. In 4307 lbs. how many cwt.?

7. In 12600 lbs. how many tons?

8. In 2048000 dr. how many tons?

9. In 64546 dr. how many cwt.?

10. Reduce 544272 dr. to T.

11. A merchant bought 4 T. 8 cwt. 42 lbs. of castings at 12c per pound. What did the whole cost him?

12. A coal dealer bought 176960 lbs. of hard coal at $5.25 per long ton and sold it at $5.75 per short ton. What did he gain?

13. A grocer bought 3 hogsheads of sugar: The first weighing 8 cwt. 13 lbs. at 4½c per pound; the second weighing 7 cwt. 82 lbs. at 4¾c per pound; the third weighing 9 cwt. 43 lbs. at 4⅝c per pound. He sold the whole by retail at 5c per pound. What was his net profit?

14. Bought 5 barrels of pork at 7½c per pound and sold it at 9c per pound. What was my gain?

15. What is the weight of 250 barrels of flour?

16. A grocer bought 3 barrels of salt at $1.25 per barrel, and retailed it at ¾ of a cent per pound. What did he gain?

17. At 45c per bushel what will be the value of 4865 lbs. of shelled corn?

18. A farmer sold 8750 lbs. of oats at 18c per bushel. What did they bring?

19. Find the value of 4627 lbs. flax seed at $3.60 per bushel.

20. What cost 5180 pounds timothy seed at $1.45 per bushel?

II. Troy Weight

161. *Troy Weight* is used in weighing gold, silver and other precious metals.

TABLE

24 grains (gr.) make 1 pennyweight...pwt.
20 pennyweights " 1 ounce ....oz.
12 ounces   " 1 pound ....lb.

In addition to the above, the following, called *Diamond Weight,* is used in weighing diamonds and other precious stones:

TABLE

16 parts   make 1 carat grain = .792 troy grains.
4 carat grains " 1 carat   = 3.168 "   "

NOTE.—The term carat is also used to denote the fineness of gold, and means $\frac{1}{24}$ part. Thus, gold 18 carats fine contains 18 parts pure gold and 6 parts alloy.

1. Reduce 4 lbs. to grains.

2. Reduce 3 lbs. 5 oz. 15 pwt. to pwt.

3. Reduce 13 lbs. 9 oz. 16 pwt. 22 gr. to grains

4. Reduce 146 gr. to pwt.

5. Reduce 32625 gr. to pounds.

6. A jeweler sold a gold chain weighing 2 oz. 16 pwt. 11 gr. at 4c per grain. How much did he receive?

7. A miner dug 17 lb. 8 oz. 9 pwt. of gold and sold it at 60c per pwt. What did it bring?

8. A goldsmith manufactured 1 lb. 1 pwt. 16 grs. of gold into rings, each weighing 4 pwt. 20 gr. He sold the rings for $1.25 apiece; what did he receive for them?

9. Eight watch cases each 14 carats fine and weighing 60 pwt. contain how many ounces of gold?

10. What is the value of a diamond weighing $\frac{3}{16}$ of a carat at $75 per carat?

III. Apothecaries' Weight

162. *Apothecaries' Weight* is used by druggists in compounding medicines.

Druggists purchase their medicines at wholesale by avoirdupois weight.

TABLE

20 grains (gr. xx)	make 1 scruple...sc. or Ə.	
3 scruples (Əiij)	" 1 dram.....dr. or ʒ.	
8 drams (ʒ viij)	" 1 ounce.....oz. or ℥.	
12 ounces (℥ xij)	" 1 pound.....lb. or ℔.	
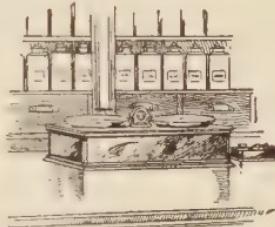
NOTES.—1. The pound, ounce and grain of this weight are the same as those of troy weight; the pound of each contains 12 oz. = 5760 gr.

2. In writing quantities in apothecaries' weight the characters denoting the denomination precede the quantity except in pounds. In practice the quantities are usually written in the Roman numerals.

1. Reduce 5 ℔. to grains.

2. Reduce 11 ℔. Ə3 to Ə.

3. Reduce 2 ℔. ℥2 ʒ2 Ə2 gr.2 to grains.

4. In ℥48 how many pounds?

5. Reduce gr.3864 to ounces.

6. In gr.25941 of rhubarb how many pounds?

7. A druggist put up gr.26376 of medicine into prescriptions, each prescription contained Ə2 gr.16. How many prescriptions did he make?

8. How much medicine will a druggist put up in one year of 365 days if he averages 8 prescriptions a day of gr.20 each?

9. An apothecary bought 3 pounds of medicine (apothecaries' weight) at $6 per pound and retailed it at 10 cents per Ə. What was his total gain?

10. What is gained by buying 4 lbs. of quinine (apothecaries' weight) at $5.50 per ℔. and after manufacturing it into capsules of gr.2 each, selling them at 25c per dozen?

11. A case of drugs weighs 14 lbs. ℥7 ʒ4. What is it worth at 5c per grain?

Comparison of Weights

163. The *Standard Unit* in both troy and apothecaries' weights is the troy pound containing 5760 troy grains.

164. The *Standard Unit* in avoirdupois weight is the pound which is equal to 7000 troy grains.

COMPARATIVE TABLE OF WEIGHTS

	Troy	Apothecaries	Avoirdupois
1 pound =	5760 grains =	5760 grains =	7000 grains
1 ounce =	480 " =	480 " =	437.5 "
	175 pounds =	175 pounds =	144 pounds

1. Change 25 lb. 7 oz. 15 pwt. troy to avoirdupois pounds.

2. A druggist bought at wholesale 15 lb. quinine at $5.50 per pound avoirdupois, and after making the entire quantity up into 2 gr. pills sold the pills at 40c per dozen. What did he gain?

3. A case of drugs weighs 76 lbs. avoirdupois. How much is that troy?

4. In 65 lbs. avoirdupois, how many troy pounds?

5. Bought 16 lb. of opium, avoirdupois weight, at 50c an ounce and sold the same by apothecaries' weight at 60c an ounce. What was my gain?

6. In 243 oz. troy how many ounces avoirdupois?

7. What is gained by buying 8 lb. of quinine at $6 per lb. avoirdupois weight, and selling same at $\frac{1}{4}$c per grain apothecaries' weight?

8. Reduce 75 oz. apothecaries' weight to ounces avoirdupois weight.

9. Reduce 36 lb. avoirdupois weight to pounds troy weight.

10. What is gained by buying 25 lb. avoirdupois weight at $3 per lb., and selling at $3.20 apothecaries' weight?

11. Change 10 lb. 9 oz. avoirdupois weight to lb. and oz. troy weight.

12. Change 31 lb. 11 oz. apothecaries' weight to lb. and oz. avoirdupois weight.

13. Is a pound of feathers heavier than a pound of gold, and how much?

MEASURES

165. A *Measure* is a *standard unit* established by law or custom, by which the length, surface, capacity and weight of things are estimated.

Measures are of two kinds: *Measures of Extension* and *Measures of Capacity.*

166. *Extension* is that property of matter which causes it to occupy space. It may have one or more of the three dimensions: Length, breadth and thickness.

A Line has only one dimension—*length.*

A Surface has two dimensions—*length and breadth.*

A Solid has three dimensions—*length, breadth and thickness.*

MEASURES OF EXTENSION

167. *Measures of Extension* embrace Long or Linear Measure, Square Measure and Cubic Measure.

I. Long Measure

168. *Long Measure*, also called Linear Measure, is used in measuring distances or length.

TABLE

12	inches (in.)	= 1 foot . . . . ft.
3	feet	= 1 yard . . . . . . .yd.
5½ yds. or 16½ ft.		= 1 rod. . . . . .rd.
40	rods	= 1 furlong . . . .fur.
320	rods, or }	= 1 mile . . . . . . .mi.
5280	feet,	
3	geog. miles	= 1 league . . . . . . .l.

NOTES.—1. The yard for common use is divided into *halves, quarters, eighths* and *sixteenths.* At the United States Custom Houses it is divided into *tenths* and *hundredths.*

2. The mile of 5280 feet is the legal mile in the United States and England and is called the statute mile.

3. The *inch* may be divided into halves, fourths, eighths, etc., or into tenths, hundredths, etc.

Special Linear Measures

⅓ inch	= 1 size. Used by shoemakers.
4 inches	= 1 hand. Used in measuring the height of horses.
6 feet	= 1 fathom. Used in measuring depths at sea.
1.152⅔ statute mi.	= 1 geographic mile. Used in measuring distances at sea.
3 geog. mi.	= 1 league. Used in measuring distances at sea.
1 knot	= 1 geog. mi. Used in measuring speed of vessels.*
60 geog. mi.	} = { 1 degree of long. on the equator, or
69.16 statute mi.	1 degree of a meridian.
360 degrees	= circumference of the earth.

NOTE.—*The progress of sailing vessels is determined by a *half-minute glass* and a *log line*, which is divided into knots, bearing the same ratio to a mile that a half-minute has to an hour.

1. Reduce 2 yds. 2 ft. 7 inches to inches.

2. Reduce 7 yards 8 inches to inches.

3. Reduce 5 mi. to rods.

4. Reduce 8 mi. 225 rods to rods.

5. Reduce 16 mi. 25 rds. to rods.

6. Reduce 18 rds. 2 yds. 1 ft. 9 in. to inches.

7. Reduce 12760 in. to higher denominations.

8. Reduce 78980 ft. to higher denominations.

9. Find the cost of building a fence 1 mi. 165 rds. 4 yds. long at 18¾c per yard.

10. A lake is 30 fathoms 5 ft. 10 in. deep. How many inches deep is it?

11. If a vessel travels 15 knots an hour, how many leagues will she travel in 2 days of 24 hrs. each?

12. What will it cost to fence a square field at 2½c per ft., the sides of which are 14 rd. 2 yd. 1 ft.?

13. I built four fences at 30c per yd. The first was 112 rd. 1½ yd. long; the second 23 rd. 1 ft. long; the third 1 fur. 16 rd. 4 yd. 2 ft. long; the fourth 32 rd. long What was the cost?

14. How many inches high is a horse which measures 16¼ hands?

15. A vessel travels at the rate of 20 knots an hour. How many statute miles will she go in 96 hours?

16. The drive wheels of a locomotive are 24 ft. 6 in. in circumference. How many times will they revolve in going a distance of 40 mi. 118 rd. 1 yd.?

Surveyors' Long Measure

169. *Surveyors' Long Measure* is used by surveyors and engineers in measuring the dimensions of land, distance, etc.

The *Linear Unit* commonly employed by *surveyors is a Gunter's Chain,* which is 4 rods or 66 feet long, and divided into 100 links.

TABLE

7.92 inches (in.)	make 1 link........l.	
25 links	" 1 rod or pole..r.	
4 rods or 100 links	" 1 chain ....ch.	
80 chains	" 1 mile .....mi.	

NOTE.—In measuring roads, etc., engineers use a *chain,* or *measuring tape,* 100 feet long, each foot being divided into *tenths and hundredths.*

1. Reduce 22 ch. 44 l. to inches.

2. Reduce 2 mi. 70 ch. 10 l. to inches.

3. Reduce 1 mi. 20 ch. to feet.

4. Reduce 4 mi. 36 ch. to yards.

5. Reduce 16384 l. to mi.

6. A farm is 45 ch. 16 l. long and 32 ch. 18 l. wide. How many feet of fence will be required to enclose it?

II. Square Measure

170. *Square or Surface Measure* is used in measuring surfaces; as land, board, amount of painting, plastering, papering, paving, etc.

171. *A Rectangle* is a flat surface with four square corners.

172. *A Square* is a rectangle whose four sides are equal.

A Square Inch is a square each side of which is 1 inch in length. A *Square Foot* is a square each side of which is 1 foot in length. A *Square Yard* is a square each side of which is 1 yard in length.
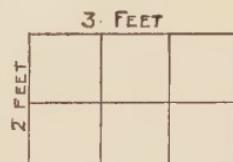
A RECTANGLE.
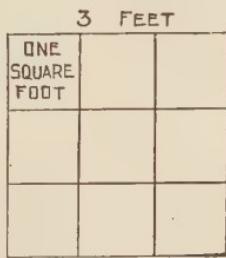
A SQUARE.

The figure shows that 1 square yard, that is 3 feet square, contains 9 square feet, and from this we deduce the principle, that

The area or surface of a square or rectangle may be found by multiplying the length by the breadth.

TABLE

144	square inches (sq. in.) make		1 square foot . . .sq. ft.
9	square feet	"	1 square yard . . .sq. yd.
30¼	square yards	"	1 square rod . . . .sq. rd.
160	square rods	"	1 acre . . . . A.
640	acres	"	1 square mile . . .sq. mi.

NOTE.—Paving, painting, calcimining, etc., are estimated by the square of 100 square feet.

1. Reduce 6 sq. yd. to square inches.

2. Reduce 10 A. to square rods.

3. Reduce 1 sq. mi. to square rods.

4. Reduce 2 sq. yd. 5 sq. ft. to square inches.

5. Reduce 5 A. 85 sq. rd. 20 sq. yd. 7 sq. ft. to square feet.

6. Reduce 65 A. 115 sq. rd. 13 sq. yd. 5 sq. ft. 120 sq. in. to square inches.

7. Reduce 960 sq. rd. to acres.

8. Reduce 2467 sq. in. to square yards.

9. Reduce 4178 sq. in. to square yards.

10. Reduce 16328 sq. in. to higher denominations.

11. How many square feet in a square measuring 7 ft. on a side?

*12.* What is the area in acres of a rectangular field measuring 150 rd. long by 80 rd. wide?

13. How much greater is the area of a lot 25 yd. square than a lot containing 25 sq. yd.?

14. How many yards of carpeting 1 yd. wide will be required to carpet a room 27 ft. long and 18 ft. wide?

15. What will it cost to paint a blackboard 46 ft. long and 4½ ft. wide, at 27c per sq. yd.?

16. Find the cost of paving a street 600 ft. long and 46 ft. wide at 85c per square.

17. Find the cost of plowing a field 58 rods long and 34 rods wide at $2.20 per A.

18. Find the number of square feet in the walls and ceiling of a room 20 ft. long, 16 ft. wide and 9 ft. 6 in. high.

19. What will it cost at $3.14 per square to plaster a court room 48 ft. long, 36 ft. wide and 25 ft. high?

20. What will it cost at $4.40 per square to put the roof on a house 52 ft. long, the rafters being 22 ft. on each side?

21. At $23 per A. what is the cost of a field 38 rd. long and 30 rd. wide?

22. Find the cost of a farm 80 rd. long and 33 rd. wide, at $36.50 per A.

23. How many yd. of carpet ¾ yd. wide, laid lengthwise, will it take to cover a floor 22 ft. long and 15 ft. wide?

24. What will it cost to carpet a room 30 ft. long and 25 ft. wide, with carpet 1¼ yd. wide, laid lengthwise, at 80c per yard?

25. Find the cost of carpeting a room 36 ft. long, 28 ft. wide with carpet ⅞ yd. wide, laid lengthwise, at $1.15 per yard.

26. Find the number of strips of carpet 1⅛ yd. wide run lengthwise of a floor 32 ft. long and 27 ft. wide. What does it cost at $1.10 per yd., allowing a waste of ⅛ yd. on each strip for matching?

27. What will it cost at 60c per sq. yd. to concrete a walk 360 ft. long and 10 ft. 6 inches wide?

28. What will it cost at 4c per sq. yd. to build a walk 14 ft. wide around a block 240 ft. square?

29. What will it cost at 12½c per sq. yd. to paper the walls and ceiling of a room 20 ft. long, 16 ft. wide and 9 ft. high?

30. What will it cost to plaster the sides and ceiling of a room 36 ft. 9 in. long, 27 ft. 6 in. wide and 10 ft. 6 in. high, at 21c per sq. yd., if 28 sq. yd. be allowed for doors and windows?

31. The length of a rectangular fish pond is 90 ft., and its width 75 feet. Immediately surrounding this pond is a sidewalk 12 ft. wide. What is the distance around the outer edge of the sidewalk?

32. A contractor received $247.50 for flagging a court-yard 30 feet long, at $2.75 per square yard. What was the width of the yard?

33. What is the difference in the areas of two rectangles, one 15 rd. long and 18½ ft. wide, and the other 71 yd. long and 3 rd. wide?

34. A tinsmith covered a roof with 1152 sheets of tin, each sheet covering 40 by 20 inches. How many square feet of roof were there?

Board Measure

173. *Board Measure* is used by lumbermen in estimating the contents of boards, plank, joists, beams, etc.

174. *A Board Foot* is 1 ft. long 1 ft. wide and 1 in. thick, or a *square foot* 1 inch thick.

Boards 1 inch or less in thickness contain as many board feet as the surface of the board in square feet.

Boards more than an inch in thickness, and all squared lumber, are estimated by the number of square feet of boards one inch in thickness to which they are equivalent. Round timber such as masts, poles, etc., are estimated by cubic feet.

175. When lumber is one inch or less in thickness, to find the number of board feet, *multiply the length in feet by the width in inches and divide by 12.*

When more than one inch in thickness, the above result must be multiplied by the number of inches thick.

How many feet, board measure, in the following:

1. A board 16 ft. long, 1 ft. wide and ¾ in. thick?

2. A board 24 ft. long, 9 in. wide and 1 in. thick?

3. A board 14 ft. long, 1½ ft. wide and 2 in. thick?

4. 25 boards 12 ft. long, 8 in. wide and 1¼ in. thick?

5. A stick of timber 6 in. by 8 in. and 18 ft. long?

6. 16 joists 2 in. by 4 in. and 13 ft. long?

7. 40 2-inch planks 14 in. wide and 14 ft. long?

8. 36 3-inch planks 9 in. wide and 20 ft. long?

9. A stick 1 ft. by 1¼ ft. and 27 ft. long?

10. What will it cost at $1.60 per hundred, to build a sidewalk 40 yd. long, 6 ft. wide, with planks ⅞ in. thick?

11. What will it cost at $18 per thousand for lumber 1¼ in. thick, to lay a floor in a room 19 by 24 ft., ¼ being allowed for matching the lumber?

12. At $12.50 per thousand, what will the lumber cost for siding a house 30 ft. long, 24 ft. wide and 16 ft. high, 30 sq. yd. being allowed for doors and windows and the gable ends being counted 544 sq. ft.?

13. Find the cost of the following bill of lumber: 10 pc. 2x4-14; 12 pc. 2x6-16; 20 pc. 2x8-18; 24 pc. 4x4-20; 20 pc. 4x8-20 @ $21 per M.; 96 pc. 2x12-16; 75 pc. 2x10-18 @ $25 per M.

Surveyor's Square Measure

176. *Surveyor's Square Measure* is used in computing the area or contents of land.

177. A *Principal Meridian* is a true north and south line established as a basis for government surveys. There are in the United States twenty-four principal meridians.

The meridians established for the purpose of government survey must not be confounded with meridians of longitude used by astronomers and navigators, as they are entirely different. The principal meridians used in surveying land are usually located with reference to some natural landmark, such as the mouth of a river, and are not equi-distant apart.

The first principal meridian starts from the junction of the Miami and Ohio rivers, forming the boundary between Indiana and Ohio; the second starts from a point two and a half miles west of the junction of the Little Blue
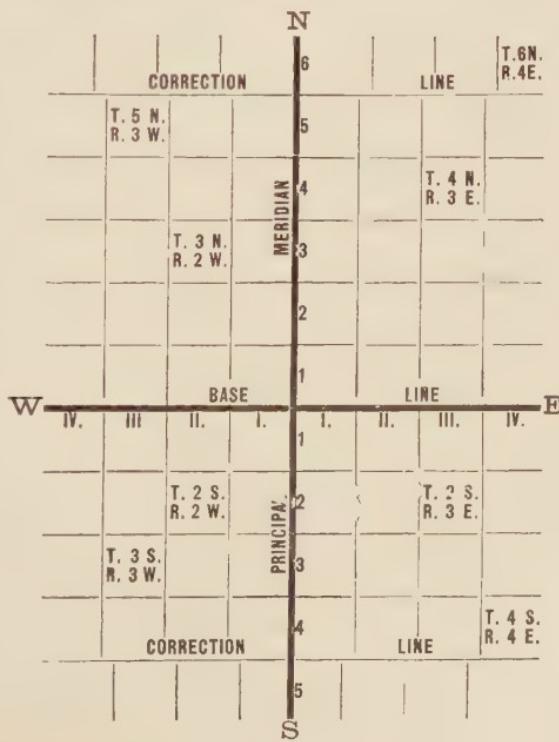
and Ohio rivers; the third starts from the mouth of the Ohio and runs north to the northern boundary of Illinois; the fourth begins at the mouth of the Illinois river and extends north through Wisconsin and Minnesota, governing surveys in Wisconsin, Northern Minnesota and Western Illinois; the fifth begins at the mouth of the Arkansas and governs surveys in Arkansas, Missouri, the greater part of Minnesota and Dakota east of the Missouri river; the sixth is the meridian of 97 deg. 22 min. west, extends south to latitude 37 deg. and north to the Missouri, and controls the surveys in Kansas, Nebraska, the Dakotas south and west of the Missouri, Wyoming and all of Colorado except a portion along the Rio Grande, which is surveyed by the New Mexico meridian.

Besides these there are eighteen principal meridians in the United States survey known by names instead of numbers. These are the Michigan meridian, governing surveys in Michigan; the Tallahassee, St. Stephens, Huntsville, Choctaw, Washington (Miss.), St. Helena and Louisiana meridians governing surveys in southern states; the New Mexico meridian, longitude 106 deg., 52 min., 9 sec.; the Great Salt Lake meridian, the Boise meridian governing surveys in Idaho; the Mount Diablo meridian, 121 deg., 5 min. west, governing surveys of Central and Northeastern California and all Nevada; the San Bernardino meridian for a part of Southern California, the Humboldt meridian for Northwestern California, the Willamette meridian for Oregon and Washington; the Montana meridian, the Gila and Salt River meridian for Arizona and the Indian meridian for Indian Territory.

N

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

W (left) **E** (right)

S

A TOWNSHIP.

178. A *Base Line* is a line which crosses the principal meridians at right angles to them, and is used as a basis of measurements north or south.

The intersections of the meridians and base lines are marked by substantial stone monuments.

Across the principal meridians and base lines at right angles, other lines are run six miles apart which

N

N. ¼.
320 *A.*

W | N. W.¼ |
of
S. W.¼
40 *A.* | E. ½
of
S. W. ¼
80 *A.* | S. E. ¼.
160 *A.* | **E**
S. W. ¼
of
S. W. ¼
40 *A.*

S
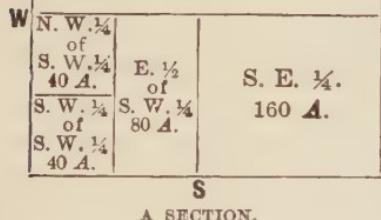
A SECTION.

divide the territory into square tracts six miles square. These tracts are called *Townships.*

179. Since the surface of the earth is convex, all meridians converge as the latitude increases; hence, the townships and sections are not *exactly rectangular,* which creates a necessity for occasional *offsets* called *Correction Lines.*

The townships are numbered north or south from the base line. Thus "town 1 north," "town 1 south," etc.

180. A *Range* is a line of townships running north and south, and is designated by its number east or west from the principal meridian. Thus the range of townships lying next a prime meridian is known as range 1, east or west, the next range 2, etc.

181. Each township is divided into thirty-six *Sections,* each 1 mile square and containing 640 acres.

These sections are numbered as shown in the accompanying diagram beginning at the N. E. cor. and running W. in the first tier, E. in the second, etc. All fractional sections except those due to lakes, rivers, and other natural boundaries are thrown into the northern and western rows. Sections are further divided into halves, quarters and eighths or forties.

TABLE

10000 square links	make 1 square chain....sq. ch.
10 square chains	" 1 acre...............A.
640 acres	" 1 square mile........sq. mi.
36 square miles (6 mi. sq.)	" 1 township.......... Tp.

1. How many acres in a township of land?

2. In 38 A. 8 sq. ch. 240 sq. l. how many square links?

3. Reduce 6525000 sq. links to acres.

4. A bought a farm of 8584250 sq. l. at \$65 per acre. What did the farm cost him?

5. A sold the S. W. ¼ of the S. E. ¼ of section 15 in a certain township at $87.50 per acre. How much did he receive for it? Locate the land in a diagram.

6. Make a diagram and locate B's farm of 40 acres in the E. ½ of the S. ½ of the N. W. ¼ of sec. 29, T. 3 N. Range 2 W.

7. I bought a half-quarter section of land at $22 per A., and sold same for $26.15 per A. How much did I gain?

8. A farmer purchased the following tracts of land: N. E. ¼ of N. E. ¼, S. W. ¼ of N. E. ¼ at $43.50 per A.; N. E. ¼ of S. W. ¼, S. E. ¼ of N. E. ¼ at $37.50 per A.; N. W. ¼ of S. E. ¼, N. E. ¼ of S. E. ¼ at $27.50 per A., and S. E. ¼ of N. W. ¼, N. W. ¼ of N. E. ¼ at $31.25 per A. Find the cost of the farm. What will it cost to enclose the farm with a board fence five boards high each 6 inches wide and 16 ft. long at $16 per M. for lumber and $25 per C. for posts, same to be placed two to the board length? Draw a diagram of the farm.

9. H's farm contains the following pieces of land: W. ½ of N. W. ¼, W. ½ of S. W. ¼, E. ½ of N. E. ¼, E. ½ of S. E. ¼, S. ½ of S. E. ¼ of N. W. ¼, S. ½ of S. W. ¼ of N. E. ¼, N. ½ of N. E. ¼ of S. W. ¼, N. ½ of N. W. ¼ of S. E. ¼. How many acres of land in his farm? Draw diagram.

10. E owns the following described property: N. W. ¼ of N. W. ¼, S. W. ¼ of N. W. ¼, N. W. ¼ of S. W. ¼, S. W. ¼ of S. W. ¼, S. E. ¼ of N. W. ¼, S. E. ¼ of S. W. ¼, N. E. ¼ of N. W. ¼, N. W. ¼ of N. E. ¼ and N. E. ¼ of N. E. ¼. How many acres does he own?

11. Draw a diagram of E's land. A public highway is laid out on the N., W. and S. sides of it of the usual width (4 rods) one half on E's land. How many acres of land will the road occupy on his land? What will it cost to fence this piece of land with a post and wire fence, posts to be placed one to the rod at $21 per C and 5 strands of wire, each strand weighing 3 pounds to the rod at 1½c per lb.?

III. Cubic Measure

182. *Cubic Measure* is used in estimating the contents of solid bodies, or things which have length, breadth and thickness.

183. A *Rectangular Solid* is a solid bounded by six rectangular sides.

184. A *Cube* is a rectangular solid bounded by six squares.

A *Cubic Inch* is a cube each dimension of which is 1 inch.   A *Cubic Foot* is a cube each dimension of which is 1 foot.   A *Cubic Yard* is a cube each dimension of which is 1 yard.

By inspecting the figure it will be readily seen that 3 cubic feet are 3 cubes of 1 foot each, and a cube 3 ft. each dimension must contain 27 such cubes or 27 cubic feet.

Hence we conclude, that

The solid contents of a body may be found by multiplying its length, breadth and thickness together.
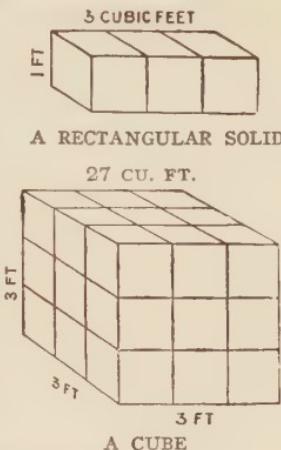
TABLE

1728 cubic inches (cu. in.) make 1 cubic foot.....cu. ft.
  27 cubic feet   "   1 cubic yard.....cu. yd.
 128 cubic feet   "   1 cord of wood.....C.

NOTES.—1. In measuring wood a pile 8 feet long, 4 feet wide and 4 feet high is called a *cord*.

2. A cubic yard of earth is called a *load*.

3. Railroad and transportation companies estimate light freight by the *space* it occupies in cubic feet, and heavy freight by *weight*.

4. A *perch* of stone or of masonry is 16½ feet long, 1½ feet wide, and 1 foot high.

1. Reduce 5 cu. yd. 12 cu. ft. to cu. feet.

2. Reduce 3864 cu. ft. to cords.

3. Find the number of cu. ft. in a solid 26 ft. long, 2 ft. wide and 1½ ft. thick.

4. Find the number of cu. yd. in a solid 25 yd. long, 14 ft. wide and 12 ft. thick.

5. Find the number of cu. yd. in a solid 12 yd. long, 12 ft. thick and 8 ft. wide.

6. How many cords are there in a pile of wood 28 ft. long, 6 ft. high and 4 ft. wide?

7. At $2.20 per cord, what will be the cost of a pile of wood 18 yd. long, 6 ft. high and 2 ft. wide?

8. How many cords of wood can be put into a building 16 ft. long, 12 ft. wide and 10 ft. high?

9. How many cu. ft. of water will a cubical cistern hold, each of whose dimensions is 5 ft.?

10. What will it cost to dig a cellar 21 ft. long, 18 ft. wide and 7 ft. 4 in. deep, at 40c per cu. yd.?

11. I bought 24 cords of wood 3 ft. long, and put it in a pile 8 ft. high. How long was the pile?

12. My sleeping room is 12 ft. long, 10 ft. wide and 9 ft. high. If I breathe 10 cu. ft. of air in one minute, in how long a time will I breathe as much air as the room contains?

13. A cellar wall is 112 ft. long, 6 ft. high and $1\frac{1}{2}$ ft. thick. What did it cost at $1.25 a perch?

14. What did it cost to dig the same cellar, its length being 32 ft., at 15 cents a cubic yard?

15. How many cubic feet in a wall 16 in. thick, 38 ft. long, and 30 ft. high? How many bricks would be required for the above wall allowing 22 to a cubic foot? What would be their value at $8.50 per thousand?

MEASURES OF CAPACITY

185. *Measures of Capacity* are those which determine the quantity of matter necessary to fill a given space.

186. *Measures of Capacity* embrace *Liquid Measure* and *Dry Measure.*

I. Liquid Measure

187. *Liquid Measure* is used in measuring liquids.

TABLE

4 gills (gi.)	make 1 pint........pt.
2 pints	" 1 quart ......qt.
4 quarts	" 1 gallon.....gal.
$31\frac{1}{2}$ gallons	" 1 barrel.....bbl.
2 barrels, or 63 gal.	" 1 hogshead..hhd.

NOTES.—1. The gallon, which contains 231 cu. in., is the unit of measure in liquids.

2. Casks of various sizes are used in commerce, called tierces, pipes, butts and tuns. In practical business each cask is gauged separately and its actual contents ascertained.

1. Reduce 13 gal. to pints.

2. Reduce 8 gal. 2 qt. 1 pt. to pints.

3. Reduce 5 hhd. to gills.

4. Reduce 5 gal. 3 qt. 1 pt. 3 gi. to gills.

5. Reduce 2 bbl. 16 gal. 1 pt. to pints.

6. Reduce 1270 pt. to gallons.

7. Reduce 13725 pt. to barrels.

8. How many barrels in 10000 gallons?

9. What will be the cost of 2 hhd. of wine at 9c a gill?

10. A merchant bought 3 barrels of cider vinegar at $5.25 per barrel and sold it at 8c a quart. What did he gain?

11. How many cans, each holding 3 qt. 1 pt. 3 gi., can be filled from a barrel of kerosene oil containing $42\frac{5}{8}$ gal.?

12. How many cubic inches in 63 gal.?

13. How many gallons in 4623 cu. in.?

14. How many gallons will a rectangular cistern hold, which is 4 ft. wide 6 ft. long and 8 ft. deep?

15. How many gal. of water will a cubical cistern hold, each of whose dimensions is 5 ft.?

16. How many gallons of water may be put into a cistern 6 ft. deep and 4 ft. square at the top?

17. A cistern 3 ft. by 4 ft. by $5\frac{1}{2}$ ft. is $\frac{2}{3}$ full of water. How many gallons does it contain?

Apothecaries' Fluid Measure

188. *Apothecaries' Fluid Measure* is used by druggists in compounding liquid medicines.

<div align="center">TABLE</div>

60 minims (℟) make	1 fluid drachm, marked	f℥.
8 f℥	"	1 fluid ounce	"	f℥.
16 f℥	"	1 pint,	"	O.
8 O	"	1 gallon,	" cong.

NOTES.—1. The symbols of this measure precede the numbers to which they refer. Thus, O4 f℥6, is 4 pints 6 fluid ounces.

2. The gallon and pint of this measure are the same as in wine measure.

   1. Reduce O3 to f℥.

   2. Reduce O5 f℥12 to f℥.

   3. Reduce cong.1 O7 f℥9 f℥5 to fluid drachms.

   4. Reduce cong.3 O5 f℥7 ℟42 to minims.

 - *5.* Reduce 1348 minims to higher denominations.

   6. Reduce 142860 ℟ to cong.

II. Dry Measure

189. *Dry Measure* is used in measuring dry articles; as grain fruit, salt, etc.

<div align="center">TABLE</div>

2 pints (pt.) make	1 quart...........qt.
8 quarts	"	1 peck...........pk.
4 pecks	"	1 bushel.........bu.

NOTE.—The 40-quart or "heaped" bushel is used for apples, potatoes, etc. Its dimensions are 18½ inches inside and 8 inches deep. When *heaped*, the cone must not be less than 6 inches high, and it contains 2747.715 cubic inches.

NOTE.—The standard unit of Dry Measure is the bushel, which contains 2150.42 cu. inches.

   1. Reduce 2 bu. to pints.

   2. Reduce 5 bu. 3 pk. to pints.

   3. Reduce 2 bu. 2 pk. 2 qt. to pints.

   4. Reduce 7 bu. 3 pk. 7 qt. 1 pt. to pints.

5. Reduce 384 pt. to bushels.

6. Reduce 47 pt. to pecks.

7. Reduce 2865 pt. to bushels.

8. Reduce 11 bu. 3 pk. 7 qt. 1 pt. to pints.

9. What will 2 bu. of nuts cost at $2\frac{1}{2}$c per pint?

10. What will 4 bu. 3 pk. of beans cost at 6c per quart?

11. What will 2 pk. 4 qt. of cherries cost at $4\frac{3}{4}$c per pint?

12. What is gained by buying 3 bu. 1 pk. of cherries at $2\frac{1}{2}$c per pint and selling same at $3\frac{1}{4}$c per pint?

13. A merchant bought 3 bu. of chestnuts at $1.20 per bu., and sold the same at 3c per pint. How much did he gain?

14. I bought 1 bu. 1 pk. 1 qt. berries at $2\frac{1}{2}$c per pint and sold same for $2.46. Find the total cost, and the selling price per quart.

15. How many cubic inches in 17 bushels?

16. How many bushels in 15590.545 cu. in.?

17. How many bu. of wheat may be placed in a bin 26 ft. long, 12 ft. high and 9 ft. wide?

18. What is the value at 23c per bu. of potatoes that fill a bin 18 ft. 5 in. long, 7 ft. 8 in. wide and 6 ft. 9 in. high?

19. At 35c a bushel, what is the value of oats which fill a bin 16 ft. long, 6 ft. wide and 4 ft. high?

20. B wishes to build a bin that will hold 2000 bu. of corn. How long must he make the bin if it is 16 ft. wide and 8 ft. high?

21. A wagon whose box is 11 ft. long, 3 ft. 6 in. wide and 2 ft. 4 in. high is filled with barley worth 48c per bu. Find its value.

22. Wheat worth $120 at 75c per bu. fills a bin 5 ft. wide and 4 ft. high. Find the length of the bin.

Comparison of Dry and Liquid Measures

190. The *Standard Unit* of *Dry Measure* is the bushel, which contains 2150.42 cubic inches.

191. The *Standard Unit* of *Liquid Measure* is the gallon, which contains 231 cubic inches.

COMPARATIVE TABLE OF MEASURES OF CAPACITY

	LIQUID MEASURE	DRY MEASURE [1]
1 gallon =	231 cu. in.	$268\frac{4}{5}$ cu. in.
1 quart =	$57\frac{3}{4}$ cu. in.	$67\frac{1}{5}$ cu. in.
1 pint =	$28\frac{7}{8}$ cu. in.	$33\frac{3}{5}$ cu. in.

1. Reduce 2 bu. 3 pk. 6 qt. dry measure to gallons liquid measure.

2. Reduce 1 bbl. 20 gal. 1 qt. to dry measure.

3. I bought 2 bu. 1 pk. 1 qt. of nuts by dry measure, at 4c per qt. I sold same at $4\frac{1}{2}$c per qt. by liquid measure. How much did I receive and what was my gain?

4. I bought 21 gal. 3 qt. of strawberries liquid measure at 5c per qt. and sold them by dry measure at 8c per qt. Find gain.

5. A person has 15 gal. of cherries liquid measure, and can sell them at 5c per qt. liquid or 7c qt. dry measure. Which is the better and how much?

6. A bushel or 32 quarts dry measure contains how many more cubic inches than 32 quarts liquid measure?

TIME

192. *Time* is a measure of duration.

The *Measures of Time* are fixed by the revolutions of the earth on its axis and around the sun.

193. A *Day* is the time required for the revolution of the earth on its axis. A *Year* is the time required for the revolution of the earth around the sun.
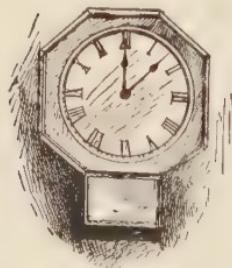
TABLE

60 seconds (sec.)	make	1 minute......min.
60 minutes	"	1 hour..........hr.
24 hours	"	1 day...........da.
7 days	"	1 week.........wk.
365 days (52 weeks 1 day)	"	1 common year.yr.
366 days	"	1 leap year......yr.
12 calendar months	"	1 year ....yr.
100 years	"	1 century ....C.

NOTES.—1. The exact length of the solar year is 365 days, 5 hours, 48 minutes, 48 seconds; but is usually considered to be 365 days, 6 hours. Hence, the year being regarded as 365 days, the odd 6 hours of each year

make in 4 years 24 hours, or an additional day, which is added to the shortest month, February, and gives 366 days to every fourth year, called *leap year*.

2. All leap years are divisible by 4 and all centennial years not divisible by 400 are common years.

194. The year is divided into calendar months and seasons as follows:

WINTER. . . . . .
$$\begin{cases} \text{January (Jan.)} \ldots \ldots \ldots \ldots \ldots \ldots 31 \text{ days} \\ \text{February (Feb.)} \ldots \ldots \ldots \ldots \ldots 28 \text{ days} \\ \text{February in leap year} \ldots \ldots \ldots 29 \text{ days} \end{cases}$$

SPRING. . . . . . .
$$\begin{cases} \text{March (Mar.)} \ldots \ldots \ldots \ldots \ldots 31 \text{ days} \\ \text{April (Apr.)} \ldots \ldots \ldots \ldots \ldots 30 \text{ days} \\ \text{May (May)} \ldots \ldots \ldots \ldots \ldots 31 \text{ days} \end{cases}$$

SUMMER . . . . .
$$\begin{cases} \text{June (Jun.)} \ldots \ldots \ldots \ldots \ldots 30 \text{ days} \\ \text{July (July)} \ldots \ldots \ldots \ldots \ldots 31 \text{ days} \\ \text{August (Aug.)} \ldots \ldots \ldots \ldots 31 \text{ days} \end{cases}$$

AUTUMN . . . . .
$$\begin{cases} \text{September (Sept.)} \ldots \ldots \ldots \ldots 30 \text{ days} \\ \text{October (Oct.)} \ldots \ldots \ldots \ldots \ldots 31 \text{ days} \\ \text{November (Nov.)} \ldots \ldots \ldots \ldots 30 \text{ days} \end{cases}$$

WINTER. . . . . .   December (Dec.) . . . . 31 days

The number of days in each calendar month may be easily remembered by committing the following lines:

> "Thirty days hath September,
> April, June and November;
> All the rest have thirty-one,
> Save February, which alone
> Hath twenty-eight; and one day more
> We add to it one year in four."

1. Reduce 2 hrs. to seconds.

2. Reduce 5 da. 8 hrs. to minutes.

3. Reduce 2 da. 7 hr. 45 min. 32 sec. to seconds.

4. Reduce 145 da. 5 hr. 27 min. 18 sec. to seconds.

5. Reduce 9 wk. 5 da. 15 hr. 25 min. to minutes.

6. Reduce 5 yr. 7 mo. 3 wk. 5 da. 16 hr. 42 min. 18 sec. to seconds.

7. Reduce 14600 sec. to hours.

8. Reduce 26345 minutes to weeks.

9. Reduce 41761 min. to months.

10. Reduce 12684500 sec. to higher denominations.

11. How many days are there from March 18 to July 1?

12. How many days are there from Nov. 26 to Feb. 22?

13. How many days are there from June 1 to Dec. 16?

14. How many days in winter in a leap year?

9

CIRCULAR MEASURE

195. *Circular Measure* is used by surveyors in determining directions, by navigators in fixing the location of vessels at sea and by astronomers in making observations on the heavenly bodies.

Every circle, great or small, may be said to be divided into 360 parts called degrees, consequently the length of a degree will vary according to the size of the circle.

196. A *Degree* is the $\frac{1}{360}$ part of the circumference of a circle.

TABLE

60 seconds (")	make 1 minute..........	'
60 minutes	" 1 degree	°
30 degrees	" 1 sign............	S.
12 signs or 360°	" 1 circumference. .	C.

NOTES.—1. A degree at the equator, also the average degree of latitude, is equal to 69.16 statute miles.

2. Minutes on the earth's surface are called geographic miles.

1. Reduce 4° 15′ 36″ to seconds.

2. Reduce 37° 48′ 52″ to seconds.

3. Reduce 12346″ to higher denominations.

4. How many degrees are there in $\frac{1}{3}$ of the circumference of the earth?

5. How many degrees in 5700 geographic miles?

6. How many minutes or geographic miles in a semi-circumference of the earth?

7. How many statute miles in 180° or the semi-circumference of the earth?

8. A ship was driven out of her course by a storm, 5° 15′ 28″. How many geographic miles was this?

197.   MISCELLANEOUS TABLE

12 things = 1 dozen.		12 gross = 1 great gross.
12 dozen = 1 gross.		20 things = 1 score.

1. What cost 3 gross pencils at 4c apiece?

2. A bought 6 doz. eggs at 18c per dozen. Suppose he had paid 2c apiece for them how much more would they have cost?

3. A merchant bought 5 doz. straw hats at $5.45 per dozen and retailed them at 75c each. What was his profit?

PAPER

24 sheets = 1 quire of paper.   2 reams = 1 bundle.
20 quires = 1 ream.   5 bundles = 1 bale or case.

The terms folio, quarto, octavo, duodecimo, etc., indicate the number of leaves into which a sheet of paper is folded.

STOCK SIZES OF FLAT OR WRITING PAPERS

14 x 17 called Cap.   18 x 23 called Medium.
16 x 21   "   Demy.   19 x 24   "   Royal.
17 x 22   "   Folio.   17 x 28   "   Double Cap.

Most flat papers are now furnished 500 sheets to the ream instead of 480 sheets, as formerly.

STOCK SIZES OF BOOK PAPERS FURNISHED 500 SHEETS
TO THE REAM

24 x 36   28 x 42   36 x 48
25 x 38   32 x 44   38 x 50

The weight of papers is graded as so many pounds per ream. The more the ream weighs the heavier each individual sheet will be. Paper of a certain size and weight may have been used and it is often desirable to know the weight per ream of an equivalent sheet but of another size.

4. A stationer bought 1 bundle of note paper for $12 and sold it at the rate of 3 sheets for 5c. What did he gain?

5. What will 408 eggs cost at 28c per dozen?

6. Find the cost of 5 great gross of lead pencils at 3c each.

7. How old is a person who is three-score and five years old?

8. Find the weight per ream of the equivalent of a sheet 24 x 36—60# in 25 x 38. In 28 x 42.

9. Find the weight per ream of the equivalent of a sheet 32 x 44—80# in 24 x 36. In 25 x 38. In 28 x 42.

10. What must be the weight of a ream of Cap to make a sheet equivalent to 24# Royal?

11. 24# Folio would be what in Double Cap?

12. 28# Royal would be what in Folio?

13. 16# Cap would be what in Royal?

14. What would be the weight of 35 sheets of 28# Double Cap?

15. What would be the weight of 16 sheets of 40# Royal?

16. An untrimmed book has 512 pages 5¼ x 7. Out of what may it be most advantageously run? How many sheets does it take for each book?

17. An untrimmed book is 5½ x 8. Out of what will it cut to best advantage? How many pages to each sheet?

18. A merchant has a catalogue 3 x 9¼ when trimmed. He wishes to bind it in a manila cover which can be had in 22½ x 28½ —90# and in 24 x 36—100#. Allowing a trim of ⅛ in. on both top and bottom and ⅛ in. trim on sides, how many covers can be cut out of each size and at 4¼ cents per pound which is the most economical size to use?

REVIEW PROBLEMS

198. *1.* What is the cost of 3 bu. plums at 8c a qt.?

2. What is the cost of 4 bu. 3 pk. peaches at 40c a peck?

3. At 28c per pk. how many bushels of apples can be bought for $36.96?

4. It requires 8 yd. 3¾ qr. to make one suit of clothes. How many suits will 143 yards make?

5. What cost 1 lb. 15 pwt. of silver ore at 2c per grain?

6. What cost 3660 lbs. of wheat at 87½c per bushel?

7. How many spoons, each weighing 2 oz. 12 pwt. can be made from 3 lb. 8 oz. 4 pwt. of silver?

8. A druggist put up 64 doz. gr.2 quinine powders. How much did he use?

9. If one bushel of wheat will make 45 lb. flour, how many barrels of flour can be made from 1000 bu. of wheat?

10. How many yd. of carpet ¾ yd. wide, will be required to cover a floor 27 ft. long and 18 ft. wide?

11. At 30c per cord, what must be paid for sawing a pile of wood 22 ft. long, 7 ft. high and 4 ft. wide?

12. I paid $10.50 for a barrel of pork. How much is that a pound?

13. How many bu. of wheat can be put into a bin 7 ft. 4 in. long, 4 ft. 10 in. wide and 3 ft. high?

14. What must be the length of a bin that is 6 ft. wide and 5 ft. 6 in. high to contain 240 bu.?

15. If a family use 4 lb. 14 oz. of sugar in a week how long will 1 cwt. 65 lb. 12 oz. last them?

16. Find the cost of 2 hhd. wine at 12c per pint.

17. The human heart beats 70 times a minute. How many times will it beat in a day?

18. At 7½c per cu. ft., what will be the cost of a block of stone 7 ft. 6 in. long, 5 ft. 3 in. wide and 4 ft. 8 in. thick?

19. At 50c per oz., what is the value of a silver cup that weighs 1 lb. 5 oz. 7 pwt. 10 gr.?

20. At $21 per M., what is the cost of 3 sticks of timber 20 ft. long and 18 in. square at the ends?

21. A druggist paid 50c a lb. Av. for potash and sold same in powders of 9 1 gr.5 at 5c each. How much did he gain on 10 lb.?

22. A cistern is 7 ft. long 5 ft. wide and 9 ft. deep. How many hogsheads of water will it contain?

23. How many square feet are there in a walk around the outside of a rectangular garden which is 100 feet long and 65 ft. wide, the walk being 3 ft. 6 in. wide?

24. How many boards 11½ ft. long and 10 in. wide will be required for the flooring of a room 17½ ft. by 23 ft.?

25. How many hours longer is summer than autumn?

26. A farmer started for market with 6 dozen dozen eggs: he broke half a dozen dozen and sold the remainder at 1c each. What did they amount to?

27. How much time will a man gain in 60 yrs. of 365 days by rising 45 min. earlier every day than his usual time?

28. How many cu. ft. in a stone 4 ft. 8 in. long, 3 ft. 2 in. wide and 2 ft. thick? How many sq. ft. on its surface?

29. A room 30 ft. long and 24 ft. wide is covered with 126 yd. of carpet. What is the width of the carpet?

30. A rectangular field containing 15 A. is 350 rd. long. How wide is the field?

31. A cistern 7 ft. long and 5 ft. wide contains 105 cu. ft. What is the depth of the cistern, and how many gal. of water will it hold?

32. What will be the cost of the plank, at $15 per M., that will cover a floor 13 ft. by 24 ft., if the plank is $1\frac{3}{4}$ in. thick?

33. How many dry qt. of berries may be put into a cask that contains $128\frac{1}{2}$ wine gallons, and what are they worth at $4\frac{1}{2}$c per qt.?

34. Find the cost of 10 pc. 2 by 4 in., 10 pc. 2 by 6 in., 15 pc. 2 by $3\frac{1}{2}$ in., 12 pc. 2 by 7 in., if the pc. are 12 ft. long and the cost is $18.50 per M.

35. How many tons of hay of 320 cu. ft. each, in a mow 40 ft. 8 in. long, 20 ft. 3 in. wide and 13 ft. 10 in. high?

36. Allowing 320 sq. ft. for doors and windows, what will be the cost at 30c per sq. yd. of plastering a room—the ceiling and walls—42 ft. 6 in. long, 26 ft. 3 in. wide and 14 ft. high?

37. I bought 14 bu. 3 pk. by dry measure at $4 per bu., and sold the same at 18c per qt. liquid measure. Did I gain or lose and how much?

38. My silver weighs 3 lb. 7 oz. by the scales of a grocer; what will it weigh by the scales of a jeweler?

REDUCTION OF DENOMINATE FRACTIONS

199. *Reduction of Denominate Fractions,* either common or decimal, is the process of changing them to equivalent numbers of different denominations.

Reduction takes place in two ways: From a higher denomination to a lower by multiplication. From a lower denomination to a higher by division.

200. *To reduce a denominate fraction to lower denominations.*

1. Reduce $\frac{5}{8}$ of a bushel to lower denominations.

SOLUTION

$\frac{5}{8}$ bu. $= \frac{5}{8}$ of 4 pk. $= 2\frac{1}{2}$ pk.
$\frac{1}{2}$ pk. $= \frac{1}{2}$ of 8 qt. $= 4$ qt.
        Ans. 2 pk. 4 qt.

From this solution and explanation we have the following:

To Reduce Denominate Fractions to Lower Denominations

a. Multiply the fraction by that number which will reduce it to the next lower denomination, and if the result be an improper fraction, reduce it to a whole or mixed number.

b. Proceed with the fractional part, if any, as before, until reduced to the denominations required.

c. The units of the several denominations, arranged in their order, will be the required result.

NOTE.—If after multiplying the fraction it is not an improper fraction, proceed to reduce it to the next lower denomination as before.

   2. Reduce $\frac{3}{8}$ of a yard to lower denominations.

   3. Reduce $\frac{4}{9}$ of a month to lower denominations.

   4. What is the value of .45 of a gallon?

SOLUTION
       .45 gal.
         4
      ‾‾‾‾‾‾
      1.80 qt.
         2
      ‾‾‾‾‾‾
      1.60 pt.
         4
      ‾‾‾‾‾‾
      2.40 gi.
1 qt. 1 pt. 2.4 gi.   Ans.

   5. What is the value of .26375 of a long ton?

   6. What is the value of $\frac{5}{7}$ of 12 cwt.?

   7. What is the value of .725 of 16 acres?

   8. What is the value of 3.48125 acres?

   9. What is the value of $\frac{3}{5}$ of $\frac{2}{3}$ of $17\frac{1}{2}$ bushels?

   10. What is the value of .165°?

   11. Reduce .8465 lb. apothecaries' weight to lower denominations.

   12. What is the value of $\frac{17}{63}$ of a mile?

13. Reduce $\frac{2}{3}$ of $\frac{1}{4}$ of 3 pounds troy to lower denominations.

14. Reduce $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of 4 lb. avoirdupois weight to lower denominations.

15. A grocer disposed of .75 of $\frac{4}{5}$ of .175 of a hhd. of molasses. What amount was that?

201. *To reduce a denominate fraction to higher denominations.*

1. Reduce $\frac{3}{7}$ of a pwt. to the fraction of a pound.

<div align="center">SOLUTION</div>

$$\frac{\cancel{3}}{7} \times \frac{1}{20} \times \frac{1}{\cancel{12}} = \frac{1}{560} \text{ lbs.}$$

Therefore we have the following:

To Reduce Denominate Fractions to Higher Denominations

a. Divide the fraction by the numbers necessary to reduce it to the denomination required.

NOTES.—1. Shorten the operation by cancellation whenever possible.
2. In case the fraction is a decimal divide as in division of decimals.

2. Reduce $\frac{2}{3}$ pwt. to the fraction of a pound.

3. Reduce $\frac{3}{5}$ of a cent to the fraction of an eagle.

4. Reduce $\frac{1}{4}$ of a foot to the fraction of a mile.

5. Reduce gr. $\frac{3}{8}$ to the fraction of a pound.

6. Reduce .25 of a pint to the fraction of a gallon.

NOTE.—.25 pt. = $\frac{25}{100}$ pt. = $\frac{1}{4}$ pt. and then proceed as before.

7. Reduce $\frac{3}{5}$ pt. to the fraction of a peck.

8. Reduce $\frac{4}{7}$ qt. to the fraction of a bushel.

9. Reduce .125 oz. to the fraction of a T.

10. Reduce .375 of a second to the fraction of a day.

11. Reduce $\frac{7}{12}$ pt. to the fraction of a bushel.

12. Reduce $\frac{3}{8}$ pt. to the fraction of a peck.

13. Reduce $1\frac{2}{7}$ qt. to the fraction of a bushel.

14. $\frac{5}{6}$ of an ounce troy is what fraction of 3 pounds?

15. $\frac{3}{5}$ of .675 pt. is what fraction of 6 bushels?

202. *To reduce a compound number to a fraction of a higher denomination.*

1. Reduce 5 da. 14 hr. 24 min. to the fraction of a week.

SOLUTION

5 da. 14 hr. 24 min. = 8064 min.

1 week = 10080 min.

$$\frac{8064}{10080} = \frac{4}{5}\,\text{wk.}$$

Therefore:

To Reduce a Compound Number to a Fraction of a Higher Denomination

a. Reduce the compound number given to its lowest denomination and that to which it is to be reduced to the same.

b. Make the former the numerator, and the latter the denominator of a common fraction, which reduce to its lowest terms.

2. Reduce 10 hr. 30 min. to the fraction of a da.

3. Reduce 215 rd. 3 yd. 2 ft. 10 in. to the fraction of a mile.

4. Reduce 1 brl. 1 gal. 1 qt. 1 pt. 1 gi. to the fraction of a hogshead.

5. What part of 11 hhd. is 4 gal. 1 qt. 1.28 pt.?

6. What fraction of 5 bushels are 3 pk. 1 pt.?

7. What part of 6 ft. square is 6 sq. ft.?

8. What part of 2 bu. 2 pk. 4 qt. is 3 pk. 7 qt. 1 pt.?

9. What part of 9 ft. square is 9 sq. inches?

10. What part of 3° is 25″?

203. *To reduce a compound number to a decimal of a higher denomination.*

1. Reduce 2 pk. 6 qt. 1 pt. to the decimal of a bu.

SOLUTION

2)1.0 pt.

8)6.5000 qt.

4)2.812500 pk.

.703125 bu.

Therefore we may prescribe the following:

To Reduce a Compound Number to a Decimal of a Higher Denomination

a. Divide the lowest denomination given by that number which will reduce it to the next higher. Prefix the next higher denomi-

*nation to this quotient. Proceed in the same manner until the
whole is reduced to the denomination required.*

    2. Reduce 8 oz. 15 pwt. 18 gr. to the decimal of a pound.

    3. Reduce 1 hr. 12 min. 18 sec. to the decimal of a day.

    4. Reduce 5 minutes to the decimal of a day.

    5. What decimal of a peck is 7 qt. 1 pt.?

    6. What decimal of a bushel is 2 pk. 3 qt. 1 pt.?

    7. What decimal of a fathom is $3\frac{5}{8}$ feet?

    8. What decimal of 3 miles is .3 feet?

    9. What decimal of a barrel of flour is 18.25 lbs.?

    10. Reduce 5 sq. yd. 7 sq. ft. 80 sq. in. to the decimal of an
acre.

    11. Reduce 5A. 60 sq. rd. 25 sq. yd. to acres and decimals
thereof.

    204. *1.* What will be the cost of 5 brls. 75 lbs. of flour at
$6.50 per barrel?

    2. What cost 18 bu. 3 pk. 5 qt. of corn at 45c per bushel?

    3. What will 45A. 122 sq. rd. 18 sq. yds. of land cost at
$450 per acre?

    4. 8 gal. 3 qt. 1 pt. 3 gi. are what part of a hogshead?

    5. A jeweler sold 10 oz. 5 pwt. 8 gr. of plated ware at the
rate of $2.40 per lb. How much did he receive?

    6. At $59.25 per acre, how much land can be bought for
$1285.40?

    7. It cost $267.30 to build a mile of fence. What will it
cost to fence both sides of a railroad 17 mi. 135 rd. $3\frac{1}{2}$ yd.
long?

    8. Reduce 5 cwt. 68 lb. 12 oz. 14 dr. to the decimal of a ton.

    9. How much greater is the area of a lot 25 rds. square,
than a lot containing 25 sq. rds.?

    10. In .5 hhd. .8 gal. .02 qt. how many pints?

    11. What decimal of 6 mi. is 3 rd. 5 yd. 2 ft. 7 in.?

    12. Find the cost of a farm 80 ch. long and 33 ch. 50 l. wide,
at $36.50 per A.

    13. Reduce 7 hr. 24 min. 18.625 sec. to the decimal of a year.

14. How many times does a wheel, 14 ft. 8 in. in circumference, turn around in going a distance of 10 miles?

15. If a person could travel a second of distance in a second of time, how long would be required to go entirely around the earth?

16. How many seconds shorter is autumn than spring?

17. At $21.75 per rod, what will it cost to grade a road 23 mi. 172 rd. long?

18. A bill of goods amounts to £46 6s.; change to U. S. money.

19. An invoice totals £176 6s. 7d.; change to U. S. money.

20. A purchase amounts to $271.64; change to English money.

21. An invoice totals £426 5s., tariff $145.60, freight $90.63. What is the total in U. S. money?

22. Bought 220 yards of cloth at £1 9s. 2d. per yard. What is the cost U. S. money?

23. A Liverpool clerk receives £960 per year, one in Boston receives $3,000. Which receives the larger salary and how much in U. S. money?

24. A Philadelphia merchant receives four invoices of goods purchased at foreign points, viz:

A bill from Sheffield amounting to £245 6s.

A bill from Paris amounting to 1463.7 fr.

A bill from Hamburg amounting to 2164.8 m.

A bill from St. Petersburg amounting to 2243.9 rubles.

Find the total of the four bills in U. S. currency.

ADDITION

205. The process of uniting numbers of different denominations is termed *Addition of Compound Numbers.*

1. Add 16 bu. 2 pk. 4 qt.; 11 bu. 3 pk. 5 qt. 1 pt.; 8 bu. 1 pk. 1 pt.

SOLUTION

| | 4 | 8 | 2 |
bu.	pk.	qt.	pt.
16	2	4	0
11	3	5	1
8	1	0	1
36	3	2	0

From this solution and explanation we have the following:

To Add Compound Numbers

a. Write the numbers so that those of the same unit value will stand in the same column.

b. Beginning at the right hand, add each denomination as in simple numbers, carrying to each succeeding denomination one for as many units as it takes of the denomination added to make one of the next higher denomination.

Notes.—1. Reduce denominate fractions, if any, to integers of lower denominations and then add.

2. It may be helpful to the student to write the numbers of the table above the columns before beginning the addition.

Find the sum of the following:

	(2)						(3)		
	20	12	4			20	100	16	16
£.	s.	d.	far.		T.	cwt.	lb.	oz.	dr.
6	14	8	3		2	12	65	10	15
5	7	9	2		3	8	42	5	0
16	4	0	1		5	15	84	11	12
11	18	2	3		2	6	32	0	8
38	43	19	9		12	41	223	26	35

4. A farmer sold six loads of wheat as follows: 23 bu. 3 pk. 7 qt. 1 pt.; 26 bu. 2 pk. 5 qt.; 18 bu. 5 qt. 1 pt.; 32 bu. 3 pk. 5 qt.; 38 bu. 3 pk. 7 qt. 1 pt. and 36 bu. 3 pk. 1 pt. What was the entire amount?

5. What is the sum of 3 mi. 180 rd. 3 yd. 1 ft. 10 in.; 5 mi. 246 rd. 4 yd. 2 ft. 9 in.; 16 mi. 148 rd. 2 yd. 2 ft. 8 in. and 308 rd. 4 yd. 2 ft. 1 in.?

6. A man has three farms. The first contains 87 A. 116 sq. rd. 25 sq. yd. 4 sq. ft. 76 sq. in.; the second 64 A. 84 sq. rd. 30 sq. yd. 8 sq. ft. 127 sq. in.; the third 128 A. 100 sq. rd. 16 sq. yd. 6 sq. ft. 42 sq. in. How much land has he in all?

7. A ship leaving Boston sailed east the first day 3° 25' 42"; the second day 3° 14' 7"; the third day 2° 58' 16"; the fourth day 3° 36' 14" and the fifth day 4° 2' 18". How far was she then east of the port of Boston?

8. A farmer sold 5 loads of shelled corn at 42c per bushel, weighing respectively 3248, 2846, 3514, 2954 and 3015 pounds. What did he receive for all?

9. What is the sum of 14 hhd. 28 gal. 1 qt. 1 pt.; 23 hhd. 16 gal. 3 qt. 1 pt.; ⅔ hhd.; 15 hhd. 18 gal. 3 qt.?

NOTE.—Reduce the ⅔ hhd. to integers of lower denominations according to Art. 202 and then add as before.

10. Add ⅗ of a mile; 13¼ rd. and 148 rd. 7 ft. 8 in.

11. Sold four town lots. The first contained 2 A. 84 sq. rd.; the second 3¼ A.; the third ⅔ of an acre; and the fourth ⅖ of ⅚ of 300 sq. rds. How much land in all?

SUBTRACTION

206. The process of finding the difference between two numbers having two or more denominations is termed *Subtraction of Compound Numbers.*

1. From 12 bu. 2 pk. 3 qt. subtract 8 bu. 3 pk. 5 qt.

SOLUTION

	4	8
bu.	pk.	qt.
12	2	3
8	3	5
3	2	6

We may therefore give the following:

To Subtract Compound Numbers

a. Write the less number under the greater and units of the same denomination in the same column.

b. Subtract the lower number from the upper if possible.

c. But, if the lower number of any order be greater than the upper, increase the upper number by as many units of that denomination as make one of the next higher; subtract as before, and carry one to the lower number of the next higher order. Proceed in the same manner with each denomination.

NOTE.—In simple subtraction, when any lower figure is greater than the upper, we borrow ten, *ten units of a lower order making a unit of the next higher.* In Compound Numbers, when the lower number of any

order is greater than that above it, *borrow the number of units in that order which makes a unit of the next higher.*

Subtract the following:

	(2)					*(3)*		
12	20	24		365	24	60	66
lb.	oz.	pwt.	gr.	yr.	da.	hr.	min.	sec.
16	8	14	7	46	218	16	28	56
4	9	10	16	13	310	5	42	37

4. A bin contains 65 bu. of wheat. If 7 bu. 3 pk. 5 qt. 1 pt. are taken out how much will remain?

5. From a hhd. of molasses there leaked out 7 gal. 3 qt. 1 pt. 3 gi. How much remained?

6. A wagon loaded with hay weighed 3 T. 4 cwt. 18 lb. 13 oz. The wagon alone weighed 8 cwt. 24 lb. 7 oz. How much did the hay weigh?

7. A New York merchant owed a London manufacturer £628 15s. 8d. 3 far. for goods bought. He paid him £265 10s. 9d. 2 far. How much did he still owe?

8. A section of land is owned by three men. The first owns 256 A. 125 sq. rd. 15 sq. yd.; the second 185 A. 64 sq. rd. 22 sq. yd. 6 sq. ft., and the third the remainder. How much land did the third man own?

9. How many weeks, days, hours and minutes are there from 15 min. after noon on April 1, to 48 minutes before midnight on September 26?

SOLUTION

	30	24	60
mo.	da.	hr.	min.
9	26	23	12
4	1	12	15
5	25	10	57

10. Find the time from October 30, 1892, to May 21, 1895.

11. A note dated December 16, 1895, was paid on August 4, 1896. How long did it run?

12. Take 3 qr. 16 sheets of paper from 1 bundle of paper.

13. A ship starts at south latitude 12° 42′ 38″ and sails to south latitude 60°. Through what distance has she sailed?

14. What length of time elapsed from 10 a. m. on September 20, 1893, to 3 p. m. on May 6, 1895?

15. From 12 cwt. 85 lb. take $\frac{3}{16}$ of a ton.

NOTE.—Reduce the fractions to lower denominations.

16. From $8\frac{9}{10}$ wk. take $5\frac{2}{3}$ da.

17. From a cask containing 42 gal. of brandy $\frac{1}{6}$ leaked out and $\frac{1}{4}$ of the remainder was sold. How much still remained?

MULTIPLICATION

207. The process of taking a number consisting of different denominations a certain number of times is called *Multiplication of Compound Numbers.*

1. Multiply 7 bu. 2 pk. 3 qt. 1 pt. by 5.

```
   SOLUTION
        4    8
bu.  pk.  qt.  pt.
 7    2    5    1
                5
──────────────────
38    1    3    1
```

Therefore,

To Multiply Compound Numbers

a. Write the multiplier under the lowest denomination of the multiplicand.

b. Multiply as in simple numbers and carry as in addition of compound numbers.

NOTE.—We multiply the lowest denomination first so as to carry from a lower to a higher.

(2)					(3)			
	4	8	2			12	20	24
bu.	pk.	qt.	pt.		lb.	oz.	pwt.	gr.
5	3	5	1		3	8	16	20
			7					9

4. A farmer owns 5 fields each containing 68 A. 86 sq. rd. 24 sq. yd. 7 sq. ft. 65 sq. in. How much land has he in all?

5. How many gallons in 5 casks each containing 18 gal. 3 qt. 1 pt. 3 gi.?

6. A laborer excavates 2 cu. yd. 5 cu. ft. 416 cu. in. of earth in one day. How much will he excavate in 17 days at the same rate?

7. What will be the weight of 23 loads of hay, each weighing 4 T. 6 cwt. 38 lb. 14 oz.?

DIVISION

208. The process of finding how many times a given number is contained in another number consisting of different denominations is called *Division of Compound Numbers.*

1. Divide 13 da. 7 hr. 25 min. 45 sec. by 5.

```
        SOLUTION
         24    60    60
    da.  hr.  min.  sec.
5)13   7    25    45
    2  15    53     9
```

Therefore we have the following:

To Divide Compound Numbers

a. Begin at the left hand and divide the highest denomination of the dividend by the divisor, and write the quotient beneath.

b. If there be a remainder after the division of any portion of the dividend, reduce the remainder to the next lower denomination, add to it the number belonging to that denomination, if any, and divide as before.

c. Continue to divide in this manner until the entire dividend has been used.

NOTE.—We begin at the left hand in order to reduce the remainders to lower denominations and thus finally succeed in dividing them.

```
        (2)                                    (3)
      4    8    2                          12   8    3    20
    bu.  pk.  qt.  pt.              lb.   ƺ.   ʒ.   Ɖ.   gr.
7)25   3    5    1               9)17   1    0    2    18
```

4. A railroad train runs 1000 mi. in 26 hours. What rate is that per hour?

5. Seventeen barrels of sugar weigh 2 T. 6 cwt. 34 lb. 8 oz. What is the average weight?

6. A man owning ½ a section of land left it to his 3 sons equally. How many acres should each receive?

7. A silversmith made half a dozen silver spoons weighing 2 lb. 8 oz. 10 pwt. What was the weight of each?

8. A farmer raised 846 bu. 3 pk. 5 qt. of wheat in a field of 16 acres. How much was that per acre?

9. A family consumes 10 bbl. of flour in a year. What is the average amount each day?

10. A cellar 45 ft. long, 30 ft. wide and 6 ft. deep, was excavated by 5 men in 6 days. How many cubic yards did each man excavate daily?

LONGITUDE AND TIME

209. Longitude is the distance east or west from an established point or meridian on the earth's surface.

Nations usually fix their own capital or national observatory as the point from which to measure longitude, but in the United States it is quite customary to reckon from the observatory at Greenwich, England.

210. *Standard Time* is the sun time of some selected meridian of longitude. *Solar Time* is the sun time, mid-day occurring at a given place when the sun reaches the meridian of that place, thus, there is a different time for every meridian. The standard time was adopted to avoid the necessary confusion caused to travelers and others by the difference of time. Railroads and many cities and towns have adopted standard time.

In the United States *eastern standard time* is the sun time of the meridian 75° west of Greenwich; *central standard time*, 90°; *mountain standard time*, 105°; *western (Pacific) standard time*, 120°. The standard time is one hour earlier in the day, in each successive belt toward the west; and one hour later in the day, in each successive belt toward the east. Thus, when it is 11 a. m. in the Eastern belt—$7\frac{1}{2}$° on each side of the 75th meridian—it is 10 a. m. in the Central belt, 9 a. m. in the Mountain belt, 8 a. m. in the Western belt.

Every circle, great or small, may be considered as divided into 360 equal parts called degrees. Since the earth turns on its axis once in 24 hours, a point on the earth's surface will describe a circumference (360°) in 24 hours; in 1 hr., the point would describe $\frac{1}{24}$ of 360° or 15°; in 1 min., the point would describe $\frac{1}{60}$ of 15° or 15'; in 1 sec., the point would describe $\frac{1}{60}$ of 15' or 15".

Therefore we have the following:

15° of longitude = 1 hour of time.
15' of longitude = 1 min. of time.
15" of longitude = 1 sec. of time.

The following table showing the longitude of important cities of the world east or west from Greenwich, England, will be used in the solution of the problems:

TABLE OF LONGITUDES

Place	Longitude				Place	Longitude			
	°	′	″			°	′	″	
Portland, Me.....	70	15	18	W.	St. Louis, Mo...........	90	12	14	W.
Boston, Mass.....	71	3	40	"	Minneapolis, Minn.....	93	14	8	"
New Haven, Conn.	72	55	45	"	Des Moines, Ia........	93	37	16	"
New York City...	74	0	24	"	Omaha, Neb...........	95	56	14	"
Philadelphia, Pa..	75	9	3	"	Austin, Tex...........	97	44	12	"
Baltimore, Md...	76	36	59	"	Denver, Colo...........	104	59	33	"
Washington, D. C.	77	0	15	"	Salt Lake City, Utah....	111	53	47	"
Richmond, Va....	77	26	4	"	San Francisco, Cal. ...	122	27	49	"
Charleston, S. C...	79	55	40	"	Sitka, Alaska...........	135	19	42	"
Pittsburg, Pa.....	80	2	0	"	Rio Janeiro, Brazil.....	43	20	0	"
Savannah, Ga.....	81	5	26	"	Honolulu, Sandwich Is.	157	52	0	"
Detroit, Mich.....	83	3	0	"	Paris, France.........	2	20	0	E.
Cincinnati, O.	84	29	45	"	Rome, Italy...........	12	28	0	"
Louisville, Ky....	85	25	0	"	Berlin, German Empire.	13	23	0	"
Indianapolis, Ind.	86	6	0	"	Vienna, Austria........	16	20	0	"
Nashville, Tenn...	86	49	0	"	Constantinople, Turkey.	28	59	0	"
Chicago, Ill.......	87	35	0	"	St. Petersburg, Russia..	30	16	0	"
Mobile, Ala.......	88	2	28	"	Bombay, India.........	72	48	0	"
Madison, Wis.....	89	24	3	"	Pekin, China	116	26	0	"
New Orleans, La..	90	3	28	"	Sydney, Australia......	151	11	0	"

1. The difference in longitude between two places is 18° 25′ 30″. What is the difference in time?

SOLUTION

$$15)\overset{60}{18°}\ \overset{60}{25'}\ 30''$$
$$\overline{1\ \ \ 13\ \ \ 42}$$

EXPLANATION.—By reference to the table of comparison on the previous page we see that 15° equal an hour of time, 15′ equal 1 min. of time and 15″ equal 1 second of time. Therefore 18° 25′ 30″ will be equal to as many hours, minutes and seconds as 15 is contained in them, and dividing according to the rules for division of Compound Numbers we have as a result 1 hr. 13 min. 42 sec.

From the foregoing we have the following:

To Change Longitude to Time

a. Divide the longitude by 15 according to the rule for division of Compound Numbers and the result will be time.

Since the reverse of division is multplication, we may reduce time to longitude by the following:

To Change Time to Longitude

a. Multiply the time by 15 according to the rule for multiplication of Compound Numbers and the result will be longitude.

Note.—If one place be in east, and the other in west longitude, the difference of longitude is found by *adding* them, and if the sum be greater than 180°, it must be subtracted from 360°.

2. The difference of longitude between two places is 30°. What is the difference of time?

3. The difference of longitude between two cities is 16° 34'. What is the difference of time?

4. The difference of longitude between New York and Chicago is 13° 11'. What is the difference in time?

5. The difference of time between two places is 2 hr. 30 min. What is the difference of longitude?

6. The difference of longitude between London and Washington is 77° 0' 15". What is the difference in time?

7. What is the difference in time between Portland, Me., and New Orleans?

8. What is the difference of time between Richmond, Va., and Des Moines, Ia.?

9. What is the difference in time between Detroit, Mich., and San Francisco, Cal.?

10. What is the difference in time between Nashville, Tenn., and Omaha, Neb.?

11. What is the difference in time between New Haven, Conn., and Denver, Colo.?

12. What is the difference in time between New York and Sitka, Alaska?

13. What is the difference in time between Rio Janeiro, Brazil, and Honolulu, Sandwich Islands?

14. What is the difference in time between Rome, Italy, and Boston, Mass.?

15. When it is noon at Charleston, S. C., what is the time at Indianapolis, Ind.?

Note.—Since Charleston is east of Indianapolis, subtract the difference of time.

16. When it is 2 p. m. at St. Louis, Mo., what is the time at Philadelphia, Pa.?

NOTE.—Since St. Louis is west of Philadelphia, add the difference of time to 2 p. m.

17. When it is noon at Chicago what is the time at Rome, Italy?

NOTE.—Since Chicago is west and Rome east of the prime meridian, the difference between their longitudes is found by taking the sum of their longitudes. Since Rome is east of Chicago, the difference of time is added to the time of Chicago to find the time at Rome.

18. When it is 1 p. m. at Omaha what is the time at Paris, France?

19. What is the time of day at Berlin when it is 2 p. m. at New York?

20. When it is midnight at Boston what is the time at Austin, Texas?

21. What is the time of day at Washington when it is 28 min. past 10 a. m. at Chicago?

22. St. Petersburg is east longitude and St. Louis is west longitude. When it is 1 a. m. at St. Petersburg, what is the time at St. Louis?

23. When it is 1 a. m. on Wednesday at Washington what is the time at Bombay? When it is 10 min. past 2 a. m. on Sunday at Bombay what is the time at Washington?

211. *The International Date Line* is an imaginary line, in crossing which navigators must either add or subtract a day in order to make their calendar correspond to that of the inhabitants of the adjacent islands.

Given the time of day and longitude of one place and the longitude of another, and the time of day of the latter is easily found but to find the correct day of the month is not always so easy. For this purpose a knowledge of the "International Date Line," a cut of which is given on the following page is indispensable.

Travelers in going round the earth to the west find themselves a day behind the calendar and when going east, a day ahead, irrespective of the time required to make the trip.
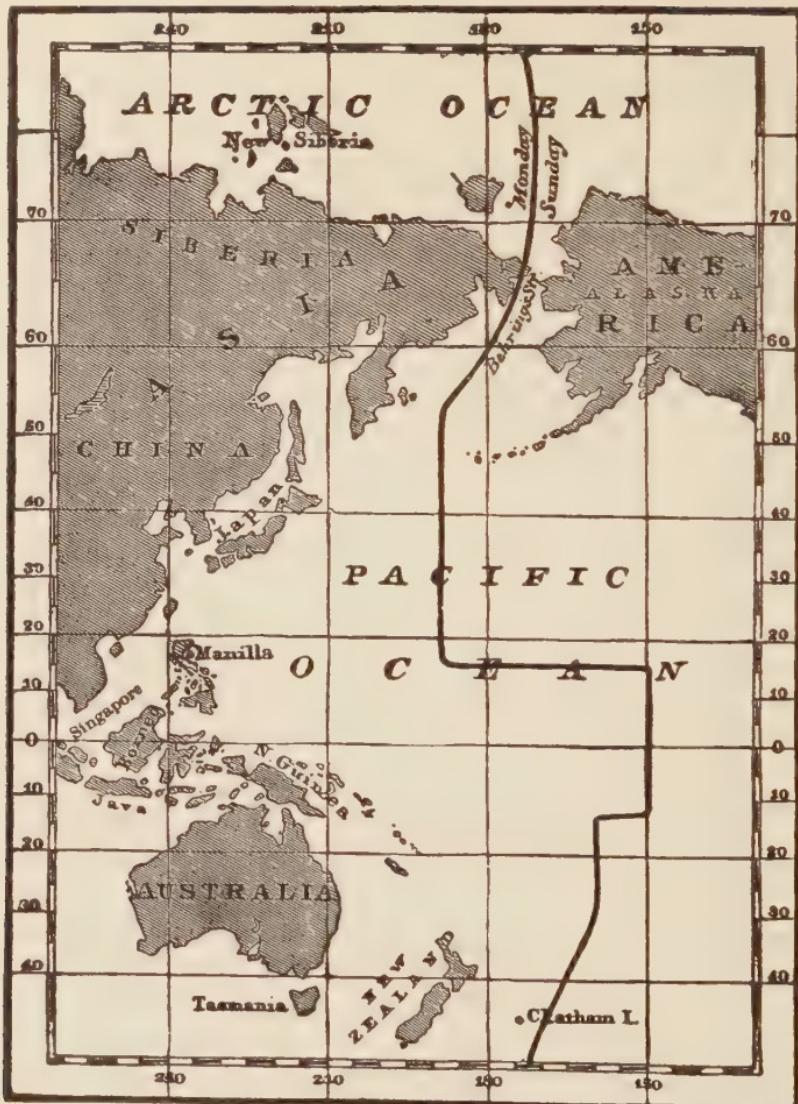
Starting from somewhere in Asia the world has been peopled by some going east and some going west. These tides, as it were, of people met in the Pacific ocean, Asia and a few islands along the coast being peopled by those coming from the west and America with the islands in the eastern Pacific by those coming from the east. Each branch brought its own time and when they met they must necessarily differ by a full day. The "International Date Line" represents where they met and hence marks the division between the two kinds of time. On one side of the line it is

a certain time of day and on the other it is the same time of either an earlier or later day according to which side of the line it may be on.

When it is 9 a. m. April 30 at Honolulu, long. 157° 20′ W., what is the day and hour on an island situated on the equator in the same degree of longitude? Being in the same degree of longitude, by the ordinary rule they would have the same day and hour, but being on different sides of the date line they differ in time by the equivalent of 360° of longitude, or 24 hours, and as the point on the equator is on the west side of the date line it first had April 30, and Honolulu did not have it for twenty-four hours afterward, hence it must be 9 a. m. May 1 at the point on the equator.

For such problems make use of the following rule: *When the date line cuts the shortest distance between two places count the long way.*

1. When it is 8 p. m. Wednesday, at Pekin, long. 116° east, what is the time at San Francisco, long. 122° west?

2. When it is 9 p. m. at San Francisco, what is the time at Pekin?

3. When it is 6 a. m. Monday, at Salt Lake City, long. 111° 53′ 47″ west, what is the time at Sidney, long. 151° 11′ east?

4. When it is 9 p. m. at Omaha, long. 95° 56′ 14″ west, what is the time at Bombay, long. 72° 48′ east?

5. Com. Dewey gave battle to the Spanish fleet in the harbor of Manila at 5 a. m. Sunday morning, May 1. If Manila is in longitude 120° E. and St. Louis is in longitude 90° W., what hour and day was it at St. Louis?

General Review Problems

212. *1.* Reduce 2 mi. 120 rd. to feet.

2. Reduce 17 T. 5 cwt. 84 lb. 13 oz. to ounces.

3. A farmer desires to send to market 58⅛ bu. of wheat in bags holding 1 bu. 3 pk. 6 qt. How many bags will it require?

4. What will 4 gal. 3 qt. of vinegar cost at 8c per quart?

5. 5 cents a quart for sweet potatoes is how much per bushel?

6. A boy picked 14 qt. of cherries a day for 15 days. How many bushels did he pick?

7. In 286453 grains apothecaries' weight how many pounds?

8. At $24.50 per square foot, what is a city lot worth which is 38¼ feet wide and 102½ feet long?

9. John Wilson rented a house for one year for $420. He occupied it from January 1, until November 20, when the house was destroyed by fire. What rent did he pay?

10. How many bottles each holding 1 pt. 2 gi. can be filled from a barrel of vinegar?

11. If a horse eats 1 pk. 3 qt. of oats in a day, how long will 16 bu. 3 pk. 3 qt. last him?

12. Reduce .185 of a day to lower denominations.

13. Reduce .00625 of a mi. to integers of lower denominations.

14. ¼ of a pwt. is what part of a pound?

15. What part of 5 T. is 4 cwt. 26 lbs. 7 oz.?

16. One bushel of apples makes 2 gal. 2 qt. of cider. How many gallons of cider can be made from 200 bu. 3 pk. 6 qt. of apples?

17. When flour is selling at $6.75 per barrel what will a 75 lb. sack cost at the same rate?

18. What decimal of 3 days is 16 hrs. 24 min. 18 sec.?

19. What is the difference between 16⅔ lb. and 13 lb. 8 oz. 16 pwt. 15 gr.?

20. Reduce 9 hrs. 24 min. 18 sec. to the decimal of a day.

21. Reduce ¼ of a mile to integers of lower denominations.

22. What is the value of .0725 of a ton?

23. A having a farm of 84 A. 136 sq. rd. 18 sq. yd. bought at one time 24 A. 118 sq. rd. 26 sq. yd. and at another time 116 A. 32 sq. rd. 14 sq. yd. How much land did he then own?

24. Add ⅗ of a mile, 11¾ rods and ³⁄₁₆ of a rod.

25. What is the sum of ⅛ of a yard, ⅛ of a foot and ⅛ of an inch?

26. Change the difference between 96 lb. 13 oz. and 14 lb. 15 oz. to the decimal of a ton.

27. What is the cost of 3 loads of apples each containing 16 bu. 3 pk. 5 qt. at 35c per bu.?

28. What is the cost of 7 bbl. of kerosene each containing 44 gal. 1 qt. 1 pt. at 12c per gal.?

29. What is the cost of 1⅓ A. land at 17½c per sq. ft.?

30. George Washington was born February 22, 1732. How old was he at the time of the Declaration of Independence?

31. The longitude of Boston is 71° 3′ 40″ west and that of Omaha, Neb., 95° 56′ 14″ west. What is the difference of time between the two places?

32. When it is 5 min. past 4 o'clock a. m. at Sydney, Australia, what is the time at Paris?

33. If a note dated April 6, 1893, has 2 yr. 3 mo. 23 da. to run, when is it due?

34. How many acres of land in a field 84 rd. long and 38 rd. 3 yd. wide?

35. How many gallons will a cistern hold which is 6 ft. 4 in. long, 6 ft. 6 in. wide and 10 ft. 8 in. deep?

36. How many bushels of potatoes will be contained in a bin 16 ft. 8 in. long, 14 ft. 3 in. wide and 9 ft. 6 in. deep?

37. Reduce 84 gal. to bushels.

38. Reduce 165 bu. to gallons.

39. Change 24 lb. avoirdupois to troy weight.

40. Bought 8 bu. assorted nuts at $4.80 per bushel dry measure and retailed them at 30c a quart liquid measure. How much was gained?

RATIO

213. *Ratio* is the quotient arising from dividing one number by another of the same kind.

214. The *Terms* of a ratio are the two numbers compared.

215. The *Antecedent* is the first term of a ratio, or dividend. The *Consequent* is the second term of a ratio, or divisor. Both terms of a ratio form a *Couplet*.

216. The *Symbol* of a ratio is the colon (:) which is the sign of division with the line taken out; thus, 8 : 2 is read: the ratio of 8 to 2. Ratio may also be expressed in the form of a fraction by writing the antecedent for the numerator and the consequent for the denominator, as $\frac{8}{2}$.

217. A *Simple Ratio* is a ratio that has one antecedent and one consequent, as 6 : 4. The value of the ratio is $\frac{6}{4}$ or $1\frac{1}{2}$.

218. A *Compound Ratio* is the product of two or more simple ratios, as (6 : 4) $\times$ (4 : 2); the value of the compound ratio is $\frac{6}{4} \times \frac{4}{2}$ or 3.

From the preceding definitions we have the following:

PRINCIPLES OF RATIO

1. Ratio = antecedent ÷ consequent.

2. Antecedent = consequent × ratio.

3. Consequent = antecedent ÷ ratio.

1. What is the ratio of 16 to 8?

SOLUTION

$$16 : 8 = 16 \div 8 = 2$$

EXPLANATION.—Since 16 is the dividend and 8 is the divisor we find the quotient or ratio by division.

From the preceding we have the following rule:

To Find a Ratio

a. Divide the antecedent by the consequent.

NOTES.—1. Since the ratio may be expressed in the form of a fraction, the principles of fractions apply to ratio.

2. Since only like numbers can be compared, there can be no ratio between $6 and 8 yd. or 5 men and 3 chairs.

2. What is the ratio of 32 to 8?

3. What is the ratio of 15 to 36?

4. What is the ratio of 16 ft. 8 in. to 1 ft. 10 in.?

5. What is the ratio of 16 to 82?

6. What is the ratio of $\frac{7}{8}$ to $\frac{5}{6}$?

7. What is the ratio of $4\frac{7}{8}$ to $11\frac{1}{2}$?

8. What is the ratio of 5 gal. 3 qt. to 2 gal. 2 qt. 1 pt.?

9. What is the ratio of 56 bu. 2 pk. 4 qt. to 4 bu. 2 pk. 7 qt.?

10. The antecedent is 85 and the ratio is 5. What is the consequent?

11. The consequent is 2.16 and the ratio is 14.5. What is the antecedent?

12. The consequent is $\frac{7}{8}$ and the antecedent is $\frac{7}{19}$. What is the ratio?

13. Find the compound ratio of $\left\{ \begin{array}{c} 8 : 16 \\ 12 : \ 3 \end{array} \right\}$.

14. What is the difference between the compound ratios of $\left\{ \begin{array}{c} 3 : 7 \\ 16 : 4 \end{array} \right\}$ and $\left\{ \begin{array}{c} 18 : 2 \\ 4 : 7 \end{array} \right\}$?

PROPORTION

219. *Proportion* is an equality of ratios and is either Simple or Compound.

220. *Simple Proportion* is an equality of two simple ratios.

The symbol of proportion is the double colon (: :) and signifies the same as =, thus, 18 : 9 : : 6 : 3 is read "18 is to 9 as 6 is to 3."

221. The *Terms* of a proportion are the four numbers compared.

222. The *Extremes* of a proportion are the first and fourth terms. In the above 18 and 3 are the extremes.

223. The *Means* of a proportion are the second and third terms. In the above 9 and 6 are the means.

224. The *Couplets* of the proportion are the ratios compared. In the above 18 and 9 are the first couplet, 6 and 3 the second couplet.

A proportion may be written, $4 : 2 : : 6 : 3 ; 4 \div 2 = 6 \div 3 ;$ $\frac{4}{2} = \frac{6}{3}$. When written in the fractional form the antecedents are written above and the consequents below the line. $\frac{4}{2} = \frac{6}{3}$, re-duced to a common denominator $\frac{4 \times 3}{6} = \frac{6 \times 2}{6}$; since numer-ators of similar fractions are to each other as integral numbers, $4 \times 3 = 6 \times 2$, but 4 and 3 are the first and last terms (ex-tremes), 6 and 2 are the second and third terms (means).

When any *three terms* of a proportion are given the other *term* may be found by the following:

Principles of Proportion

1. The product of the means equals the product of the ex-tremes.

2. The product of the means divided by one extreme equals the other extreme.

3. The product of the extremes divided by one mean equals the other mean.

Find the unknown term in the following:

1. $6 : 2 : : 9 : —.$

2. $10 : 4 : : — : 6.$

3. $9 : — : : 6 : 8.$

4. $— : 48 : : 6 : 8.$

5. $\$5 : \$12 : : 10 \text{ ft.} : — \text{ ft.}$

6. $\$21 : \$7 : : — \text{ ft.} : 3 \text{ ft.}$

7. $15 \text{ oz.} : — \text{ oz.} : : 8 \text{ bu.} : 10 \text{ bu.}$

8. $\frac{3}{5} : 5 : : 7 : —.$

9. $7\frac{1}{2} : \frac{3}{4} : : — : 4.$

10. $3\frac{1}{3} : — : : 8 : 3.$

11. $— : \frac{1}{2} : : 6 : 2.$

12. $\$4\frac{1}{4} : \$3 : : 6 \text{ lb.} : — \text{ lb.}$

13. $9 \text{ horses} : 15 \text{ horses} : : — \text{ T} : 5 \text{ T.}$

14. $5\frac{1}{4} \text{ gal.} : — \text{ gal.} : : \$7 : \$8.$

225. In any problem in simple proportion three terms are given, and a fourth term is required.

226. *To Make a Statement* in proportion is to arrange the three given terms, so that two of them form one ratio, the remain-ing term and the unknown term another ratio.

1. If 8 barrels of potatoes cost \$20, what will 25 barrels cost?

SOLUTION

brl.   brl.   \$.   \$.

$8 : 25 : : 20 : —$

$25 \times 20 \div 8 = 62\frac{1}{2}.$

Therefore we have the following rule:

To Find the Fourth Term of a Proportion

a. Place for the third term that which is of the same denomination as required.

b. If the term required be greater than the third term, place the larger of the other two numbers for the second term; if smaller, place the smaller of the two numbers for the second term.

c. Multiply the third term by the second and divide by the first.

NOTES.—1. If the terms of any couplet be of different denominations, they must be reduced to the same unit value.

2. If the divisor and dividend contain one or more factors common to both, they should be cancelled.

2. If 15 acres of land produce 535 bu. of oats, how many bushels will 32 acres produce?

3. If 6 barrels of flour cost $32, what will 75 barrels cost?

4. What must be paid for 15 tons of hard coal, if 2 tons cost $15?

5. If 8 men earn $75 in one week, how much will 14 men earn in the same time?

6. If $90, principal, produces $12.60, how much interest will $420 produce?

7. I paid $42.50 for 17 barrels of apples. How many barrels could I buy for $85?

8. I can walk 12 miles in 4 hours. How many hours will it take to walk 57 miles?

9. If 23 trees bear 143 bu. 3 pk. of apples, how many apples will 96 trees bear?

10. If 18 barrels of flour contain 3528 lb., how many pounds will 26 bbl. contain?

11. What is the cost of 17 gal. 1 qt. of wine, if 3 gal. cost $4.40?

12. I borrowed $320 for 3 mo. 18 da. For what time should I loan $212 to return the favor?

13. If $\frac{2}{3}$ of a yard of cloth cost 18c, what will $7\frac{3}{4}$ yd. cost?

14. 25 men built a wall 120 ft. long in a day. How many feet will 65 boys build a day, if 5 boys do as much as 4 men?

15. If 15 men can build a bridge in 10 days, how many men will be required to erect three of the same dimensions in $\frac{1}{2}$ the time?

16. If a man receive $4.50 for 3 days' work, how many days ought he to remain in his place for $25?

17. If a troy ounce of gold is worth $19.20, what is an avoirdupois ounce worth?

18. If 3 cwt. 14 lbs. of sugar cost $15.70, what will 42 lbs. cost?

19. A butcher used a false weight $14\frac{3}{4}$ oz., instead of 16 oz. for a pound. Of how many lbs. did he defraud a customer who bought 112 lbs. from him?

20. Suppose a certain pasture, in which are 20 cows, is sufficient to keep them 6 weeks; how many must be turned out, that the same pasture may keep the rest 24 weeks.

COMPOUND PROPORTION

227. *Compound Proportion* is an equality of ratios, when one or both are compound.

Any problem in compound proportion may be stated and solved as in simple proportion, and all of the principles and explanations of simple proportion apply equally to compound proportion.

228. *Cause and Effect* is a method of stating problems in Compound Proportion.

Cause and Effect is based upon the principle that like causes produce like effects, and that effects are in proportion to their causes.

1. If 8 men will mow 24 acres of grain in 9 days of 8 hours a day, how many men will be required to mow 48 acres in 12 days working 9 hours a day?

SOLUTION

1st Cause. 2d Cause. 1st Effect. 2d Effect.

$$\left\{\begin{matrix} 8 \\ 9 \\ 8 \end{matrix}\right. : \left\{\begin{matrix} \times \\ 12 \\ 9 \end{matrix}\right. : : \left\{\begin{matrix} 24 \\ 9 \\ 3 \end{matrix}\right. : \left\{\begin{matrix} 48 \\ 4 \end{matrix}\right.$$

$$8 \times 4 \div 3 = 10\frac{2}{3}.$$

EXPLANATION.—The first cause produces the first effect and the second cause produces the second effect. 8 men, 9 days, 8 hours constitute the cause which effects 24 acres to be mown. An unknown number of men, ×, 12 days, 9 hours constitute the

second cause which effects 48 acres to be mown. The × or unknown quantity may appear in either of the four terms, and should be placed wherever the question of the unknown appears in the problem. Employ cancellation between any mean and any extreme. Multiply the remaining extremes together and divide by the remaining mean; the result will be the unknown mean.

From the foregoing solution and explanation we have the following rule to find the unknown quantity by:

Cause and Effect

a. Write for the first term the first cause and its effect for the third term. Write for the second term the second cause and its effect for the fourth term.

b. Place the × in whichever cause or effect the question occurs in the problem.

c. Cancel from either mean to either extreme, multiply the remaining means together and the remaining extremes together and divide one by the other. The result will be the unknown term.

2. If 12 horses eat 18 loads of hay in 8 weeks how many weeks will it take 20 horses to eat 32 loads of hay?

3. If a stone 15 ft. long, 6 ft. thick, weighs 12 tons, how long must a stone be that weighs 20 tons, and is 5 ft. thick?

4. If the carpet for a room 24 by 18 ft. costs $12, what will it cost to carpet a room 30 by 22 ft.?

5. I paid $1800 for a lot 125 by 188 ft. What will a lot cost whose dimensions are 320 by 400 ft.?

6. If 6 men in 18 days of 10 hours each, earn $220, how much can 9 men earn in 24 days of 9 hours each?

7. If a box 12 ft. long, 8 ft. high and 6 ft. wide contains 480 bushels, how high is a box 15 ft. long, 5 ft. wide that contains 500 bushels.

8. If 27 hogs, each weighing 280 lbs., cost $960, what will 36 hogs, each weighing 350 lbs. cost?

9. If $900 for 1 yr. 4 mo. at 6% earns $72 interest, what will $630 earn in 2 yr. 1 mo. at 9%?

10. What will be the cost of 18 logs, 24 ft. long, 15 in. wide and 9 in. thick, if 4 logs, 16 ft. long, 10 in. wide and 8 in. thick, cost $45?

11. If 120 men in 9 days of 8 hours each, build a wall 80 rods long, 6 ft. high and 4 ft. wide, how many hours per day must 90 men work to build a wall 65 rods long, 5 ft. high, 4 ft. wide in 12 days?

12. What will a pile of brick 33 ft. long, 18 ft. high and 15 ft. wide cost if a pile 24 ft. long, 15 ft. high and 11 ft. wide, cost $325?

13. What will it cost to paper the walls of a room 25 ft. long, 18 ft. wide and 12 ft. high, if it cost $44.20 to paper the walls of a room 36 ft. long, 28 ft. wide and 10 ft. high?

14. If 12 pieces of cloth, each containing 34 yd., $\frac{7}{8}$ yd. wide, cost $204, what will 8 pieces cost, each containing 42 yd., $\frac{2}{3}$ yd. wide?

15. If 4 men, working 8 hours a day, can reap a field of grain of 20 acres in 8 days, in how many days can 9 men, working 10 hours a day, reap a field containing 35 acres?

16. If 25 men can build a wall 4800 ft. long, 7 ft. high, and 1½ ft. thick in 42 days of 8 hours each, in how many days of 10 hours each will 200 men build a similar wall 1 mile long, 8 ft. high and 2 ft. thick?

17. If the interest on $540 for 1 year (360 days) at 5% interest is $27, what is the interest on $925 for 284 days at 7%?

18. If a person can read a book containing 380 pages, each page containing 42 lines, each line 12 words, in 17½ hours, how many hours will be required to read 2 books, each containing 480 pages, each page 50 lines, and each line 15 words?

19. If a bin 8 ft. long, 4½ ft. wide, and 2½ ft. deep holds 67½ bu., how deep must another bin be made that is 24 ft. long and 6¼ ft. wide to hold 625 bu.?

20. How many men will be required to excavate a cellar 40 ft. wide, 172 ft. long, and 16 ft. deep, in 12 days of 8 hours each, if 6 men can dig a similar one 14 ft. long, 12½ ft. wide and 8 ft. deep in 5 days of 10½ hours each?

21. If 4 compositors in 18 days of 8 hours each, set up 165 pages of a book, each page containing 34 lines, each line containing 10 words, and each word containing on an average 8 letters, in how many days of 9½ hours each, can 6 compositors set up a book of 340 pages, each page 48 lines, each line 11 words, and each word 9 letters?

MEASUREMENTS USED IN BUSINESS

229. In estimating labor and materials, contractors use the following :

1 square foot	=	144 sq. inches.
1 square yard	=	9 sq. feet.
1 square	=	100 sq. feet.
1 cubic foot	=	1728 cu. inches.
1 cubic yard	=	27 cu. feet.

NOTE.—In writing dimensions, the accent mark (′) is used to indicate feet and the double accent (″) ; to represent inches. Thus 4 ft. 3 in. are written 4′ 3″.

230. *Excavating* is estimated by the cubic yard of the actual amount of material displaced.

A cubic yard of earth in its natural position will occupy from $1\frac{1}{4}$ to $1\frac{1}{2}$ cu. yds. when dug.

On public works a cu. yd. of earth is a standard load.

231. *Foundations* are estimated by the cubic foot, in either concrete or stone.

Foundations are generally composed of either concrete or large flat stones, called dimension stones.

In estimating foundations of either, the concrete, dimension, or rubble stone, the actual contents are measured.

When foundations are composed of rubble stone they are estimated by the perch at $24\frac{3}{4}$ cu. ft.

232. *Rubble Stone Work.*—Stone is estimated by the perch.

All of the outside walls of buildings below the surface of the ground are usually composed of rough stone or rubble stone work.

In estimating rubble stone work a perch of $24\frac{3}{4}$ cu. ft. is used

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extensively by contractors. In the western states the cord consisting of 100 cu. ft. is sometimes used. $\frac{1}{10}$ is allowed for mortar.

In measuring for the amount of stone or brick required in a building, girt the building and subtract four times the thickness of the wall for the corners.

Openings less than 4′ 0″ are not deducted.

Cut Stone Work is estimated by the cubic foot.

The stone used for the facing and trimming of buildings above the surface of the ground is called cut stone, and is estimated by the cubic foot for the bulk of such material. This stone is usually 4″ thick.

Mouldings, sills and string courses are generally estimated by the linear foot.

233. *Brick Work* is estimated by the cubic foot and also by the thousand.

Brick are of two kinds: Common and pressed. Pressed brick are used mostly for the facing of walls of buildings, exposed to the street.

Pressed brick work is seldom more than one brick or 4″ in thickness and is estimated by the superficial foot.

Common brick of standard dimensions are 8″ x 4″ x 2″. The bricks of different localities may vary slightly from this.

$7\frac{1}{2}$ bricks laid in a wall one brick thick are usually estimated as a square foot, and this multiplied by the number of bricks in the thickness will give the number of bricks in 1 sq. ft. of the face of the wall.

In measuring for the amount of material required, girt the building and subtract four times the thickness of the wall. For each corner of wall greater or less than 90° add 1′ 6″ to length of girt. Chimneys and hollow walls are measured as solid. Circular walls add $\frac{1}{8}$.

Openings, if 2′ 6″ wide or less are not deducted. Greater than this deduct $\frac{1}{2}$.

234. *Estimating Work.*—In estimating the amount of work done in laying stone and brick, the length of the wall is found by measuring around the wall on the outside, or by measuring on the

inside and adding 8 times the thickness of the wall. The corners are thus counted twice because more difficult to lay.

235. *Roofing* is estimated either by the square or by the thousand shingles.

A shingle is estimated to average 4″ wide by 16″ to 18″ long and is usually laid 4″ to the weather.

900 shingles laid 4″ to the weather cover 1 square of 100 sq. ft. 1000 shingles laid 4″ to the weather will cover 111 sq. ft. Allowing for waste 1000 shingles are estimated to cover 1 square.

Slating, gravel roofing, tinning, etc., are estimated by the square.

236. *Concrete Floors* are estimated by the superficial foot or yard.

No deductions are made for piers, chimneys or other projections of walls unless they amount to 10 sq. ft. in area.

237. *Plastering* is estimated by the square yard from floor to ceiling for walls, and from wall to wall for ceiling.

Usually in measuring the plastering in a room, $\frac{1}{2}$ of the openings are taken out. Plaster mouldings, cornices and the like are estimated by the linear foot. These are measured on their longest dimension and 1′ 0″ is added for each angle or corner around which the cornice is to break.

A bunch of lath contains 50 pieces, each 4′ long, and will cover 3′ of surface.

Openings in lathing and plastering are not deducted unless 2′ 0″ wide. One-half of contents is to be deducted for openings from 2′ 0″ to 6′ 0″ wide.

238. *Painting and Glazing* is estimated by the square yard or by the square of 100 sq. ft.

In measuring a building for painting, the tape is carried around and into all projections or corners.

In measuring doors take the actual superficial measurement, carrying the tape into mouldings. Windows are measured without allowance for glass.

239. *Carpenter work* is estimated by the board foot.

Doors and windows are estimated by the piece.

PROBLEMS

240. *1*. What will be the expense of excavating a cellar 28′ 6″ wide, 42′ 3″ long and 4′ 8″ deep at $1.30 per cu. yard?

2. A cellar floor to be concreted is 27′ 3″ long and 13′ 8″ wide at 8½c per sq. foot. What will be the cost?

3. How many bricks 8″ x 4″ will it take to pave a yard which is 16′ 0″ x 25′ 0″?

4. The plans of a house show that it is to contain five rooms: The first 12′ 0″ x 10′ 8″, the second 15′ 0″ x 9′ 6″, the third 14′ 0″ x 9′ 10″, the fourth 11′ 3″ x 8′ 6″, and the fifth 7′ 2″ x 5′ 9″. What amount of lumber will be required to floor these rooms after allowing ¼ for waste?

5. A man having the contract for excavating a cellar 6′ 0″ deep for a house 35′ 4″ wide by 62′ 8″ long at $1.15 per cu. yd. finds on beginning the job that the digging and hauling will cost him $1.30 per cu. yd. but he can sell the dirt for $.50 a yard. In determining the amount of earth sold, assume that its volume increases one-fourth by swelling when it is loosened in digging. How much will he make on his contract?

6. The walls of a building are 1′ thick and the building is 30′ long 20′ wide 32′ high. How many bricks of standard size do they contain, and what will be the cost at $11 per M. bricks?

7. Suppose in the preceding example the walls are faced with pressed brick worth $40 per M. when laid in the wall, the thickness of the walls remaining the same, what are the walls worth?

8. Three piers of a bridge are of rubble stone 8′ 0″ wide, 24′ 0″ long and 28′ 6″ high. What will they cost at 40c per cubic foot, making no allowance for excavating?

9. How many perch of stone are contained in the walls of a cellar 30′ 0″ wide, 50′ 8″ long, 9′ 6″ high and 1′ 3″ thick?

10. There are three rooms in the basement of a house. The first is 16′ 0″ x 9′ 6″; the second is 12′ 4″ x 8′ 0″, and the third is 10′ 8″ x 8′ 6″. What will it cost to concrete the floors of these three rooms at 8c per square foot?

11. How much will it cost to plaster a room if the length is

25' 0", the width 16' 0", and the height 17' 5" at 15c per square yard?

12. How many feet of 2x4 studding will be required for a partition 23' 9" in length, 10' 0" high, if they stand 15" to centers (one stud at each end), making no allowance for waste? What will be the cost of the studding at $17 per M.?

13. The joists in a house are 16' long and are 2 x 6's laid 1' 4" to centers for a distance of 48' 0". What will they cost at $18 per M.?

14. How many bricks are required for a building, the walls of which are 58' long, 25' wide, 44' high, and 1' thick, making no allowance for windows, doors, or corners.

15. At $3.75 per M. for bricks, and $4.25 per M. for laying them, what will the walls of such a building cost?

16. I wish to saw a square yard from a plank 15" wide and 2" thick. How far from the end must I cut?

17. What is the difference in area between 2 rectangles, the first being 4' 5" x 6' 8" and the second 5' 4" x 8' 6".

18. How many ordinary bricks required for the walls of a house, 60' deep, 36' high, 24' wide, if 240 sq. feet be allowed for windows and doors, the walls being 3 bricks thick?

19. In the walls of a cellar, the thickness of which is 1' 6", the height 8', each side wall 52' and each end wall 25' how many perch of stone? At $4.87½ a perch, what will it cost to build the walls of this cellar?

20. What will it cost to wainscot both sides of a hall 48' 9" long, to the height of 5' at 75c per sq. ft.?

21. A skylight is 42' long and the rafters are 16' 4" long on each side to the ridge. What will be the cost of glazing the same at 60c per square foot, the gables not being glazed?

22. What will be the cost of a gravel roof on a building 50' x 150', deducting for a court 25' x 40', at $3.50 per square?

23. It is desired to shingle a roof: the following dimensions are given: Length 100 ft., width 24 ft.; shingles to be exposed 4 inches and average 4 in. in width, the shingles on the lower course being doubled. The shingles will cost $3.25 per M. and

it will cost $2 per M. to lay them. What will it cost to put on the roof?

24. The roof of a barn is 50 ft. long, and the width of each side is 25 ft. from the ridge to the eaves. Shingles are to be laid exposed 5 in. to the weather and average 4 in. in width. If the first course is doubled on each side, how many shingles will be required for the roof?

PERCENTAGE

241. *Percentage* is the department of arithmetic, which treats of all operations in which 100 is the basis of computation.

242. The term *Per Cent.* from the Latin, *per centum,* means by, or on the hundred. 2 per cent. is 2 of every hundred or two hundredths. $3 gain on $100 is a gain of 3 per cent. or three hundredths on each dollar.

243. The *Sign %* is generally used for the words *per cent.;* 4% means 4 per cent., $8\frac{1}{2}$% means $8\frac{1}{2}$ per cent.

244. Since any *Per Cent.* is a number of hundredths, it may be written as a decimal or a fraction. Thus 6 per cent. $= 6\%$ $= .06 = \frac{6}{100}$.

Since hundredths occupy two places, every *per cent.* requires at least two decimal figures, and if the per cent. is less than 10 a cipher must be prefixed to the figure denoting the per cent.

When the decimal point is used in expressing any per cent., the words per cent. and the sign % are omitted; when the words per cent. or the sign % is used, the decimal point is omitted.

245. In solving problems in Percentage, five quantities are considered: *Base, Rate, Percentage, Amount* and *Difference.*

246. The *Base* is that on which Percentage is computed.

247. The *Rate* is the number of hundredths to be taken of each unit of the Base.

248. The *Percentage* is the number of hundredths of the whole Base as indicated by the Rate.

249. The *Amount* is the sum of the Base and the Percentage.

250. The *Difference* is the difference between the Base and the Percentage.

In all departments of Arithmetic, except Percentage, we use *one* as the basis of computation, while in Percentage, we use *one hundred* as the basis of computation; in this only does the work differ.

The principal applications of Percentage are to the computation of *Commission, Brokerage, Insurance, Profit* and *Loss, Duties* or *Customs, Interest, Discount* and *Exchange.*

In Percentage and all its applications

1. The Base is represented by 100%.

2. The Amount is represented by 100% plus the given rate.

3. The Difference is represented by 100% minus the given rate.

4. The Percentage is represented by the given Rate.

251. *Given Base and Rate to find Percentage.*

ORAL PROBLEMS

1. If 100% = the whole of a thing, what part of it is 50%? 25%? 20%? 10%? 5%? 4%? 2%?

2. How would you get 50% of a thing? 25%? 20%?

3. What is 25% of a bushel of apples? 50%? 75%?

4. What is 25% of 4 bushels of apples? 50%? 75%?

5. What is $33\frac{1}{3}$% of 6 bu.? 12 bu.? 24 bu.? 75 bu.?

6. What is 50% of 18 qt.? 37 qt.? 45 qt.? 63 qt.?

7. What part of a thing is $12\frac{1}{2}$%? $37\frac{1}{2}$%? $62\frac{1}{2}$%? $87\frac{1}{2}$%?

8. What is $37\frac{1}{2}$% of $40? $56? $64? $72? $88? $96?

9. A man has $120 and lost $12\frac{1}{2}$% of it, how much did he lose, and how much has he left?

10. A man having $150 spent 10% for board, 20% for a suit of clothes and 5% for books. How much did he spend for each and how much has he left?

WRITTEN PROBLEMS

1. What is 20% of $840?

SOLUTION	Or,
1. 100% = $840.	$840 Base.
2. 1% = $8.40.	.20 Rate.
3. 20% = $168.	$168.00 Percentage.

From this solution and explanation we have the following method of solution:

To Find the Percentage

a. Let 100% equal the given number or Base.

b. Find the value of 1% by pointing off two decimal places.

c. Find the value of the given Rate by multiplication.

Or,   Multiply the Base by the Rate expressed decimally.

2. What is 6% of $400?

3. What is 12% of $950?

4. What is 18% of $1440?

5. What is 24% of $2160?

6. What is 35% of $1750?

7. What is 45% of 1800 bushels?

8. What is 52% of 20500 men?

9. What is 115% of 3462 feet?

10. What is 165% of 2450 pounds?

11. What is $8\frac{3}{5}$% of $480?

12. What is $6\frac{7}{8}$% of 24360 bushels?

13. What is 14% of $\frac{7}{8}$?

14. What is $2\frac{1}{2}$% of $7\frac{3}{4}$?

15. What is $33\frac{1}{3}$% of $\frac{8}{15}$?

16. What is $\frac{2}{3}$% of $28.30?

17. What is $\frac{4}{5}$% of $420?

18. A man had $2460 and gained in business 28% of this amount. What was his gain?

19. A merchant having $5640 worth of goods in store, reduced his stock 25% by an auction sale. What amount of goods was sold, and what amount still remained?

20. Bought a house and lot for $6450 and sold it for 92% of its cost. What was the loss?

21. What is the difference between 19% of $2635, and 15% of $3267?

22. A library was sold for $4500. A bought 30% of it; B 25%; C 20%, and D the remainder. What per cent. of the whole was D's purchase and what did it cost him?

23. A banker failed but afterwards paid 34% of his indebtedness. He owed Jones $2475 and Brown $1432. How much will each receive?

24. A man owning $\frac{5}{8}$ of a store building sold 60% of his share. What part of the building did he sell and what part did he still own?

25. Find 10% of 20% of $265.

26. Find 40% of 20% of 15% of $450.

27. A owed B a sum of money. At one time he paid him 40% of it; at another time he paid 25% of what was still owing. How much then remained unpaid?

28. A grain dealer bought 16240 bushels of grain, of which 36% was wheat, 27% was oats, 18% was rye and the balance was corn. How many bushels of corn did he buy?

29. A newspaper publisher having 4560 subscribers, lost $12\frac{1}{2}$% of them; 20% of the remainder failed to pay. How many paying subscribers had he?

30. I had $1600 deposited in a bank. On July 1st I drew out 20% of it; on August 15, $16\frac{2}{3}$% of the remainder and on September 10, an amount equal to 75% of the amounts previously drawn. How much still remained in the bank?

252. When the given per cent. is an aliquot part of 100, instead of multiplying by the rate, multiply by the aliquot part of 100. Thus:

$$2\tfrac{1}{2}\% = \tfrac{1}{40} \qquad 12\tfrac{1}{2}\% = \tfrac{1}{8}. \qquad 33\tfrac{1}{3}\% = \tfrac{1}{3}.$$
$$5\% = \tfrac{1}{20} \qquad 16\tfrac{2}{3}\% = \tfrac{1}{6}. \qquad 50\% = \tfrac{1}{2}.$$
$$8\tfrac{1}{3}\% = \tfrac{1}{12}. \qquad 20\% = \tfrac{1}{5}. \qquad 66\tfrac{2}{3}\% = \tfrac{2}{3}.$$
$$10\% = \tfrac{1}{10}. \qquad 25\% = \tfrac{1}{4}. \qquad 75\% = \tfrac{3}{4}.$$

Find the percentage in the following problems:

1. 20% of $560.

2. 25% of 1280 bu.

3. $33\frac{1}{3}$% of 3645 yd.

4. $16\frac{2}{3}$% of 1428 lb.

5. $6\frac{1}{4}$% of $2860.

6. 5% of 4532 yd.

7. 10% of 286 doz.

8. $12\frac{1}{2}$% of 1432.

9. $2\frac{1}{2}$% of $3600.

10. 50% of 2436.

11. $8\frac{1}{3}$% of 168 bbl.

12. 25% of $1472.

253. *Given Base and Rate to find Amount or Difference.*

ORAL PROBLEMS

1. What is 25% more than a whole thing? 50%? $37\frac{1}{2}$%?

2. What is $40 plus 25% of itself? 20%? 50%? 75%?

3. What is 60 bu. less 10% of itself? 20%? 25%? 75%?

4. A has $100, he spends 20% for a fishing outfit, 10% of the remainder for a pair of shoes and 75% of the remainder for railroad fare. How much did he spend for each and how much has he left?

5. A merchant starts in business with $500; the first year he increased his capital 20% and the second year he increased this sum 25%. How much had he at the end of the second year?

WRITTEN PROBLEMS

1. A man bought a horse for $108, and sold it for 25% more than the cost. What did he receive for the horse?

SOLUTION

1. 100% + 25% = 125%, the amount.		Or,
2. 100% = $108.		$108.
3. 1% = $1.08.		1.25
4. 125% = $135.		540
		216
		108
		$135.00

From the foregoing solution we have the following:

To Find the Amount or Difference

a. Add the given Rate to 100% if the Amount is required, or subtract the given Rate from 100% if the Difference is required.

b. Let 100% equal the given number or Base.

c. Find the value of 1% by pointing off.

d. Find the value of the Amount or Difference per cent. by multiplication.

Or, Multiply the Base by the Amount or Difference per cent. expressed decimally.

2. The Base is $240, the Rate is 35%, find the Amount.

3. The Base is $7.20, the Rate is 20%, find the Difference.

4. The Base is 130 gals., the Rate is 40%, find the Amount.

5. The Base is 225 feet, the Rate is $33\frac{1}{3}$%, find the Difference.

6. The Base is 2500 yds., the Rate is $12\frac{1}{2}$%, find the Amount.

7. What is received for a lot that cost $450, and is sold for 20% less than cost?

8. A man invested $4850 and gained 22% during the year. How much was his capital at closing?

9. A dealer bought 26 hogs at $5.50 each, and sold them at a

gain of 18%. What did he receive for them? If he had sold at a loss of 26%, what would he have received?

10. A field produced last year 465 bushels of wheat. It produced 65% more this year. How many bushels did it produce this year?

11. I bought 400 sheep and lost 10% of them, after which I sold 45% of what I had left. How many did I have left?

12. A hatter bought a hat for $5 and sold it so as to gain 25%. What did the hat sell for?

13. A speculator having $4273, lost 10% of his money by a venture. How much did he lose, and how much had he left?

14. A merchant lost 12½% of his sales by bad debts. His sales amounted to $5428; what was the amount of his collections?

15. In a school 20% of the pupils are absent and there are 685 enrolled. How many pupils are present in the school?

16. A merchant invested in business $12500. The first year he increased his capital 18%, the second year he increased the capital at the close of the first year 24%. What was he worth at the end of the second year?

17. A stock of goods which cost $6820, decreased in value 33⅓% and then again 20% of its lessened value when it was sold. What did it bring?

18. A man dying left an estate worth $15000. He gave 30% of it to his wife; 20% of the remainder to his elder son; 25% of the remainder to his younger son, and the remainder to his daughter. What was the share of each?

19. A firm began business with a capital of $27800. The first year they gained 12% which was added to the capital; the second year they gained 18% which was added to the capital; the third year they lost 15%. What was the firm worth at the end of the third year?

20. A watch cost $134, and another cost 25% more than the first. What was the cost of both?

254. *Given Rate and Percentage to find Base.*

ORAL PROBLEMS

1. 25 is $\frac{1}{2}$ of what number? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$?

2. 36 is $\frac{1}{2}$ of what number? $\frac{1}{4}$? $\frac{2}{3}$? $\frac{3}{4}$? $\frac{6}{7}$?

3. 50% of a thing is what part of it? 25%? $66\frac{2}{3}$%? 75%?

4. 48 is 50% of what number? 75%? $66\frac{2}{3}$%?

5. One boy has \$2.50; this is 25% of another boy's money. How many dollars has this boy?

6. \$25 is 10% of what number? 20%? 30%? 40%? 50%?

7. 10% of \$75 is $\frac{1}{3}$ of what number? $\frac{1}{4}$? $\frac{1}{5}$?

8. 25% of 48 bu. is 50% of how many bushels?

9. $37\frac{1}{2}$% of 72 quarts is $33\frac{1}{3}$% of how many quarts?

10. $33\frac{1}{3}$% of A's money equals $37\frac{1}{2}$% of B's money. How much money has B if A has \$72?

WRITTEN PROBLEMS

1. \$840 is 20% of what sum?

SOLUTION

1. 20% of the required sum = \$840.
2. 1% " " " = \$42.
3. 100% (the required sum) = \$4200.

Or,
.20)\$840.00
\$4200

From the foregoing solution and explanation we have the following:

Rate and Percentage Being Given to Find the Base

a. Let the given Rate equal the Percentage or number given.
b. Find the value of 1% by dividing.
c. Find the value of 100%.
Or, Divide the Percentage by the Rate expressed decimally.

2. 420 is 8% of what number?

3. 252 is 18% of what number?

4. 720 is 32% of what number?

5. 75 is 40% of what number?

6. Of what sum of money is \$987, 47%?

7. Of what number of dollars is \$45, $2\frac{1}{2}$%?

8. I paid \$150 for a horse, and found it had cost me $16\frac{2}{3}$% of my money. How much had I at first?

9. A farmer sold 90 sheep which was $22\frac{1}{2}\%$ of his flock. How many sheep did he have at first and how many left?

10. A retail merchant bought from a jobber 225 yards of cloth, which was $37\frac{1}{2}\%$ of all the jobber had. How much had he before he sold this?

11. By selling a house for $288 more than it cost, the owner gained 8%. What was the cost and selling price of the house?

12. Jones has $280 which is 35% of Smith's money and $9\frac{1}{3}\%$ of Brown's money. How much has each?

13. A farmer paid $62.40 for a wagon. The cost of the wagon was 80% of the cost of his horse. How much did he pay for both?

14. A field produced 1470 bushels of oats last year and this was 42% of what it produced this year. This year's crop was sold for 34 cents per bushel. Find the amount received.

15. A collector collected $2925, which was 75% of the claim. What was the claim and what was the collector's commission if he received $3\frac{1}{5}\%$ on the amount collected?

16. The assets of a firm consist of cash $3250, notes $1810, and real estate $2740. The assets are $39\frac{3}{16}\%$ of the liabilities. What are the liabilities of the firm?

17. The expenses of a clerk are as follows: $180 for board, $72 for lodging, $68 for clothes, $25 for books, $37 for incidentals. His total expenses are 32% of his salary. What is his salary?

18. A man bought $66\frac{2}{3}\%$ of a flock of 240 sheep; the number he bought was $53\frac{1}{3}\%$ of what he already had. How many sheep did he buy, and how many did he then have?

19. A boy bought a pair of boots for $2.80, a cap for $.65, a knife for $.45, and a pair of skates for $1.60; he had 45% of his money left. How much had he at first, and how much did he have remaining?

20. Brown gave his son $37.50, which was 60% of what he gave his daughter and 25% of what he gave his wife; he had $87\frac{1}{2}\%$ of his money left. How much had he at first, how much did he give his wife and how much did he give his daughter?

255. *Given Amount or Difference and Rate to Find Base.*

ORAL PROBLEMS

1. What number plus 25% of itself equals 30?

2. What number plus $33\frac{1}{3}$% of itself equals 50?

3. What number minus 25% of itself equals 75?

4. What number minus $66\frac{2}{3}$% of itself equals $45?

5. What number increased by 25% of itself equals $25? 45 bu.? 60 qt.? $120? 2400 min.?

6. What number diminished by $12\frac{1}{2}$% of itself equals 21 bu.? 42 hr.? 84 sec.? $140? $91?

7. A man spent 12% of his money, he then finds that he has $176. How much had he at first?

8. A has a certain number of horses, he buys 25% of his present number. He now has 250 horses. How many had he at first?

WRITTEN PROBLEMS

1. I gained 20% by selling my house for $840. How much did the house cost me?

SOLUTION

		Or,
1. 100% + 20% = 120%, the amount.		
2. 120% = $840.		1.20)$840.00
3. 1% = $7.		$700
4. 100% = $700.		

From the foregoing solution and explanation we have the following:

Amount or Difference and Rate Being Given, to Find the Base

a. Let 100% plus the given Rate equal the Amount, or 100% minus the given Rate equal the Difference.

b. Find the value of 1%.

c. Find the value of 100%.

Or, Divide the Amount or Difference by the Amount or Difference per cent. expressed decimally.

2. $560 is 12% more than what sum?

3. 375 is 25% more than what number?

4. 280 is 40% more than what number?

5. $440 is 12% less than what sum?

6. A's fence is 4029 feet long which is $18\frac{1}{2}\%$ longer than B's. How long is B's fence?

7. Smith raised 2535 bushels of corn. Smith had $15\frac{1}{2}\%$ less than Brown. How many bushels did Brown have?

8. A man owes $960 which is 40% less than the money he has on hand. How much has he?

9. The weight of two hogs is 591 pounds, which is $1\frac{1}{2}\%$ less than the weight of three others. Find the weight of the five hogs.

10. A blacksmith sold a wagon for $270 and gained 20% on the cost. Find the cost and what he should sell for to gain $18\frac{2}{3}\%$.

11. The amount of a note that was on interest at 8% for one year, was $756. How much was the principal, and how much was the interest?

12. I sold 5% of my sheep to A, $4\frac{1}{2}\%$ of them to B, 3% of them to C. I then had 175 sheep. Find the number I had at first and the number sold to each.

13. A salesman's salary is $726, which is 21% more than his salary for last year, and that was 20% more than his salary for the previous year. Find his salary for each year.

14. A house is valued at $1620, caused from a rise of 35% in real estate, and its value before the rise was 20% more than its first cost. Find the cost.

15. A farmer sold one horse for $175 and thereby lost 25%. Had he sold the horse for $215 would he have gained or lost and how much?

16. A man dying left 25% of his property to his wife, 50% of the remainder to his son, 75% of the remainder to his daughter, and the balance $500 to a servant. What was the value of his estate?

17. 1612 is 6% of 50% of $87\frac{1}{2}\%$ more than what number?

18. In a company of 87 the children are $37\frac{1}{2}\%$ of the women, who are $44\frac{4}{9}\%$ of the men. How many of each?

19. A dry goods merchant increased his sales 20% the second year over the first; 30% the third year over the second, and $33\frac{1}{3}\%$ the fourth year over the third. He then found that his

total sales for the first four years had been $45552. What were his sales for the first year?

256. *Given Base and Percentage to find Rate.*

ORAL PROBLEMS

1. 15 is what part of 30? of 45? of 75? of 105?

2. 15 is what per cent. of 30? of 45? of 75? of 105?

3. 25 is what per cent. of 25? 50? 100? 7500?

4. 1 hr. 20 min. is what per cent. of 4 hrs.?

5. What per cent. of 75 is 15? 25? 50? 150? 225?

6. A has $50 and B has $75. A's money is what per cent. of B's money? B's money is what per cent. of A's money? A's money is what per cent. of what both have? B's money is what per cent. of what both have?

WRITTEN PROBLEMS

1. A house cost $960 and was sold at a profit of $240. What per cent. of profit was this?

SOLUTION   Or,

1. $960 = 100%. $960)$240.00(.25 or 25%

2. $1 = $\frac{5}{48}$%.   1920

3. $240 = 25%.   4800

                                      4800

From the foregoing solution and explanation we have the following:

Base and Percentage Being Given to Find the Rate

a. The Base equals 100%.

b. Find the value of a unit of the Base.

c. Find the value of the Percentage.

Or, Divide the Percentage by 1% of the Base.

2. 18 is what % of 360?

3. $48 are what % of $400?

4. 35 sheep are what % of 500 sheep?

5. 75 yards are what % of 300 yards?

6. 448 bushels are what % of 1120 bushels?

7. 250 lbs. are what % of 750 lbs.?

8. 115 feet are what per cent. of 920 feet?

9. 72 gallons are what % of 864 gallons?

10. 2 bushels 2 pecks are what % of 10 bushels?

11. A dealer bought a wagon for $72 and sold it for $21.60 more than it cost. What % did he gain?

12. A farmer sold 36 bushels from a bin containing 160 bushels of oats. What % of the oats did he sell?

13. The rent of a house worth $3600, is $720. The rent is what % of its value?

14. A farmer harvested 420 bushels of wheat from 21 bushels of seed. The seed was what % of the amount harvested?

15. $768 profit was received from an investment of $4800. Find the rate of profit.

16. Jones paid his attorney $32.50 for collecting a debt of $520. What per cent. of the debt was paid for collecting it?

17. A banker's assets are $4260, and his liabilities $7100. What % can he pay his creditors? How much will A receive, whose account is $860?

18. I received $1904 for a farm that cost $1700. How much % did I gain, and what % would I have lost by selling for $1445?

19. A father divided his estate of $2540 among his three sons: to the oldest, he gave $1016; to the next oldest, he gave $889; to the youngest he gave $635. What % of the estate did he give each?

20. A farmer who had 650 sheep, sold 182 to West; 169 to Packard; 156 to Young. What % of the flock did he retain and what % did each buy?

21. A merchant bought an invoice of goods for $365.60 and sold them for $406.73. The gain is what % of the cost?

22. A capitalist owns a house worth $7500, the income from which is $510 a year. What % does his investment bring him?

23. A Wyoming cattle dealer lost 137 head of cattle during a blizzard out of a herd of 548 head. What per cent. of the herd was left?

24. A man owned $\frac{1}{4}$ interest in a mill and sold 25% of his interest for $2860. His income from remainder was $858. What was the entire income from the mill and what % does the mill pay?

257. *1.* Jones had 275 horses and lost 24% of them. What number did he lose?

2. A bought a drove of hogs for $2895, and sold them at a profit of 8⅖%. Find his gain.

3. How much above cost must goods, that cost $9.80 per yard, be marked to gain 15%?

4. The invoice price of a lot of merchandise was $710. A discount of 19% was allowed. Find the amount of discount.

5. I sold 92 bbls. of flour at $8.25 per bbl., and received 3¼% for selling same. What amount did I receive?

6. Lyman sold 90 shares of bank stock of $100 each at a premium of 11⅘%. How much was the premium?

7. A farmer harvested 780 bushels of oats last year, and 35% more this year. Find the number of bushels harvested this year.

8. Davis invested $4368 in business and gained 26½% on the investment. Find his present capital.

9. Find the selling price of cloth that cost $1.46 per yard, and sold at a gain of 45%.

10. West purchased goods that were marked $18.40, at a discount of 19½%. How much did he pay for the goods?

11. An agent purchased 1240 yards of cloth at 95 cents per yard. He charged 4½% for buying. How much did he receive?

12. B bought $6400 worth of stock at a discount of 14%. Find what the stock cost him.

13. A farmer bought 72⅖ acres of land, which was 16% of what he already had. Find the number of acres he had before buying.

14. A manufacturer sold a carriage for $246.50, thereby gaining 25%. Find the cost of the carriage.

15. Goods costing $76, were sold at 12½% gain. What was received for them, and what would have been received by selling them at 6¼% loss?

16. Goods were sold at $384, at a loss of 14⅔%. What was the cost, and what % would have been gained by selling them for $492.80?

17. An agent's charges for buying were $22.50 and his rate of charges was $4\frac{1}{2}\%$. What was the amount of the purchase?

18. The dividend on stock was $837, the rate of dividend was 9%. Find the value of the stock and the number of shares at $100 each.

19. B had $620. He paid $24 for a desk, $122 for a safe, and $71 for books. What % of his money did he pay out, and what % remained?

20. The invoice price of goods was $288. The discount allowed by the seller was $43.20. Find the rate of discount.

21. A horse dealer sold two teams for $240 each. On one, he gained 20%; on the other, he lost 20%. Did he gain or lose by the transaction, and how much?

22. A sold 3432 bushels of corn, which was 12% less than B sold and 16% more than C sold. How many bushels did B and C sell?

23. The entire cost of goods was $207. The charges were $17.68 for freight, $2.12 for cartage and 4% of first cost for insurance. Find the first cost of the goods and what % of the first cost the charges were.

24. A speculator invested $4280 in railroad stocks. He lost 10% the first year; gained 15% the second year; gained 25% the third year; lost 5% the fourth year. Find the value of the investment at the end of the fourth year.

25. A debtor paid me $66\frac{2}{3}\%$ of his account. With 75% of the money received I bought a horse for $150. How much was the account?

26. A farmer sold 20% of 70% of 800 bushels of wheat at $\frac{4}{5}$ per bushel. How much money did he receive?

27. If $1260 are gained by selling property at a profit of $16\frac{2}{3}\%$, what would be received by selling it at a loss of $16\frac{2}{3}\%$?

28. How much more % is gained on an article bought at $9 and sold for $12, than on one bought at $8 and sold for $10?

29. 35% of a piece of land, 40 chains long and 35 chains wide, was sold at $22 per acre; and 25% of the remainder was sold at $19.50 per acre; what now remained was sold at $17 per acre. Find the total amount received.

30. Smith owned 46% of a farm worth $7250. He sold 30% of his share to Preston, and 22% of his share to Walker. Find the value of the land he now owns.

31. 19% of a merchant's stock of goods was destroyed by fire. He sold 60% of the remainder at 25% profit, and sold what now remained at 12% profit. How much did he receive, his stock at first being worth $4400?

32. I bought 100 yards of carpet at $.80 per yard. I sold 52 yards at $.92 per yard, and the remainder at 15% profit. How many % did I gain on the whole lot?

33. Davis raised 1003 bushels of potatoes, which were 18% more than 80% of the number of bushels King raised. Find the number of bushels King raised.

34. Equal quantities of coffee that cost $19\frac{3}{4}$ cents, $22\frac{1}{2}$ cents, $24\frac{1}{4}$ cents, and $29\frac{1}{2}$ cents are mixed and sold at 30 cents. What is the gain %?

35. In a sum of money containing $1300, $585 is currency, $455 is gold, and $260 is silver. What % of the sum is in currency; what % in gold; what % in silver?

36. A merchant who began business with $1500, gained 35% the first year. 80% of the gain was left in the business. The second year he gained 30% on what he had. Find his capital at the close of the second year.

37. A farmer paid $720 for a horse, a wagon and a reaper. He paid 60% more for the wagon than for the horse; and 25% more for the reaper than for the wagon. How much did he pay for each?

38. A manufacturer owning 60% of a factory, sold $12\frac{1}{2}$% of his share at 20% profit and received $1440. Find the value of the factory.

39. Brown deposited 65% of his money in a bank. He paid 40% of the remainder to Myer on a debt, and 30% of what yet remained for a suit of clothes; when he found he had but $14.70 left. How much did he have at first?

40. The value of my farm increased 20%, and again 25%; then it decreased 10%, and again 20%. I now sold for $2160.

Find the original value of the farm and the amount I would have received if I had sold after the second increase.

41. A capitalist has $7\frac{1}{2}\%$ of his money invested in U. S. bonds; 12% in real estate; $33\frac{1}{3}\%$ in bank stock; 15% in mortgages; $4\frac{1}{6}\%$ in city bonds; $40000 in telegraph stock. He has on deposit $3500. Find the value of his property.

42. A paid $4800 for two houses. 20% of the brick house was equal to 30% of the frame house. Find the cost of each.

43. 25% of A's money is equal to 30% of B's money, and 40% of B's money is equal to 32% of C's money. How much money has each, if 35% of C's money is $252?

44. A dealer purchased a quantity of oysters, fish and clams, and paid for the entire quantity $166.75. The cost of the fish was 45% of that of the oysters, and the cost of the clams 25% of that of the oysters and fish together. What was the cost of each?

45. The sales of a firm were increased 25% the second year, 20% the third year, and $16\frac{2}{3}\%$ the fourth year. What was the amount of sales during the first year, if the fourth year's sales were $64442?

46. The amount is $361.10, the percentage $47.10. What is the rate of percentage?

PROFIT AND LOSS

258. *Profit and Loss* are commercial terms used to express the gain or loss in business transactions.

259. *The Cost* of goods is the sum paid for them, or the expense of producing them.

The Prime Cost of an article is its original or first cost.

The Gross Cost is the original cost of an article increased by all expenses such as freight, duty, packing, commissions, cartage, etc.

260. *The Selling Price* of goods is the sum received for them.

261. *Profit* is the sum above cost for which goods are sold.

262. *Loss* is the sum below cost for which goods are sold.

The gain or loss is usually estimated in business transactions at a certain % on the gross cost.

263. In computations in profit and loss

1. Cost = Base.

2. Gain or Loss = Percentage.

3. Selling price at a profit = Amount.

4. Selling price at a loss = Difference.

The subjects of Profit and Loss, Marking Goods, Trade Discount, Commission, Insurance, and Taxes are but applications of Percentage. Their problems may be classified the same as in Percentage but as these classifications have been duly considered in the study of Percentage they will not be repeated in these subjects. The pupil should endeavor to clearly understand the relations of the parts of a problem that are given and from these by a process of reasoning determine the unknown or required part. He should learn as rapidly as possible to become independent of either formula, rule or classification, for in business problems are not presented tabbed with a rule nor classified by a case.

ORAL PROBLEMS

1. I paid $4 for a hat and sold it at a gain of 25%. How much did I gain?

2. Find the gain: Cost $84, sold at a gain of 10%? 20%?

3. Find the loss: Cost $60, sold at a loss of 20%? 25%?

4. Find the gain in the following: Cost $120, sold at a gain of 12%? 20%? 25%? $33\frac{1}{3}$%? Cost $75, sold at a gain of 10%? 30%? $66\frac{2}{3}$%? 25%? Cost 36 cents, sold at a gain of $12\frac{1}{2}$%? $33\frac{1}{3}$%? 125%?

5. Find the loss in the following: Cost $64, sold at a loss of $12\frac{1}{2}$%? $37\frac{1}{2}$%? $87\frac{1}{2}$%? Cost $72, sold at a loss of 100%? $66\frac{2}{3}$%? 75%? Cost 50 cents, sold at a loss of 25%? $66\frac{2}{3}$%? 90%?

6. 25 = $\frac{1}{2}$ of what number? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$?

7. 25 = 50% of what number? $33\frac{1}{3}$%? 25%? 20%?

8. $40 = 20% of what number? 30%? 40%? 60%?

9. In the sale of a horse $25 was gained. Find the cost if the sale was made at a profit of 10%? 20%? 25%? $33\frac{1}{3}$%? 50%? 40%? 30%?

10. A dealer gained $120 on a sale, which was at a gain of $16\frac{2}{3}$%. What was the cost?

11. 24 is $\frac{1}{5}$ more than what number?

12. 24 is 20% more than what number?

13. $36 is $12\frac{1}{2}$% more than what number?

14. A horse was sold for $150 thereby gaining 20%. What did the horse cost?

15. By selling berries at 10c per quart a grocer gains 25%. Find the cost of the berries.

16. A merchant sold potatoes at 84 cents per bushel thereby losing $12\frac{1}{2}$%. What did the potatoes cost per bushel?

17. An article cost $36 and sells for $48. How much was gained? What part is the gain of the cost price? What per cent.?

18. I paid $6 for each of 5 chairs and sold them for the following sums: $7, $8, $9, $10 and $11. What was the gain in each case and what was the per cent. gain?

19. A dealer paid $25 for each of 4 cows and sold them for the following amounts: $30, $35, $40 and $45. What was his gain per cent. in each case?

20. Find the gain or loss per cent. in the following:

Cost.	Selling price.		Cost.	Selling price.
$4.	$5.		$20.	$15.
$6.	$8.		$25.	$20.
$7.50	$10.		$12.50	$10.
$12.	$18.		$50.	$45.
$ .63	$ .72		$27.50	$24.75

21. Find the selling price in the following:

Cost.	Gain.		Cost.	Loss.
$1000.	50%		$960.	$16\frac{2}{3}$%
$50.	10%		$40.	5%
$2.50	20%		$24.	1%
$30.	$33\frac{1}{3}$%		$1600.	$12\frac{1}{2}$%
$240.	$63\frac{2}{3}$%		$80.	$2\frac{1}{2}$%
$10.	25%		$62.50	4%

WRITTEN PROBLEMS

264. *1.* A bill of goods cost $280 and was sold at a profit of 25%. What was the gain?

SOLUTION	Or,
1. 100% = $280.	$280
2. 1% = $2.80.	.25
3. 25% = $70.	————
	1400
	560
	————
	$70.00

2. A merchant sold goods that cost $185 at a gain of 12%. Find his gain.

3. What is the loss on goods that cost $140, and sold at a loss of 18%?

4. I bought 170 yards of cloth at 80 cents per yard, and sold it at a gain of 35%. Find my total gain.

5. A commission merchant bought 210 bbls. of apples at $2\frac{1}{4}$ per bbl., and sold them for 9% less than cost. How much did he lose?

6. The loss on a bill of goods was $21.20, which was 4% of the cost. Find the cost.

7. Lyman gained $58.38 by selling at a profit of 14%. What did the goods cost him?

8. A jeweler sold a ring for $2.25 less than it cost, and lost $7\frac{1}{2}\%$. How much did he pay for the ring?

9. A stock dealer bought 26 hogs that averaged 285 lbs., at 7 cents per lb., and sold them at $11\frac{1}{2}\%$ profit. Find his gain.

10. Miller bought two horses for $80 each, and sold one at a gain of 27%, the other at a loss of 19%. Find his net gain.

11. A quantity of tea was sold for $414, which was 10% below cost. Find the cost.

12. The selling price is $360, the rate of gain is 20%. Find cost.

13. The selling price is $189, the rate of gain is 5%. Find cost.

14. The selling price is $140, the rate of gain is $16\frac{2}{3}\%$. Find cost.

15. A firm gained 12% of its capital. The amount of gain was $1410. Find the firm's capital.

16. A real estate dealer gained $21\frac{1}{2}\%$ by selling a house for $344 more than it cost him. Find the cost of the house.

17. A stock dealer bought a lot of cattle for $1200, and sold them at a gain of 15%. What were they sold for?

18. A broker bought a bond for $920, and sold it at a gain of $17\frac{2}{5}\%$. Find his selling price.

19. The selling price is $224, the rate of loss is 20%. Find cost.

20. The selling price is $387.20, the rate of loss is 12%. Find cost.

21. How much is received for goods, bought for $355 and sold at $12\frac{1}{4}\%$ less than cost?

22. What is gained by selling real estate that cost $1272, at a gain of $8\frac{1}{3}\%$?

23. Hall sold a house and lot to Miller for $650 more than cost, and gained 20%. Miller sold it to Davis at a gain of 16%. What did the house cost each?

24. A grain dealer sold corn at 33 cents per bushel, thereby

losing 25%. **If the entire loss was $825, how many bushels did he sell?**

25. The selling price is $21, the rate of loss is $12\frac{1}{2}\%$. Find cost.

26. I sold 10 acres of land at 27% gain, and received $825.50 for it. What was the cost per acre?

27. A sold 65 yards of cloth for $89.10, and gained 15%. Find the cost of the cloth per yard.

28. Ward sold his property for $1080, which was $33\frac{1}{3}\%$ more than it cost him. How much did he pay for the property?

29. I sold a coat at a loss of $16\frac{2}{3}\%$ and lost $4.50. How much did I pay for the coat, and what would I have gained by selling it at a profit of $33\frac{1}{3}\%$?

30. If 28 yards of cloth are bought at $5.50, for how much must it be sold to gain 32%?

31. A purchased a bill of goods amounting to $430. He paid $3\frac{1}{2}\%$ for freight and cartage. For how much must he sell them to gain 13% on the entire cost?

32. Amos Libby paid $30 for a cow, and sold it for $37.50. Find the rate of gain.

33. Hill lost $6 on a watch that cost him $75. What was his rate % of loss?

34. B bought a lot of books for $60, and sold them for $70. What % did he gain?

35. I sold an acre lot that cost $90, for $75.60. Find my % of loss.

36. C. W. Carey paid $750 for a hall. He rented it nine evenings at $5 per evening, and then sold it for $825. What was his gain %?

37. A dealer sold 125 hogs at a loss of 8%. He received $1150 for them. How much did he pay per head for the hogs?

38. A partner's loss was $2250, which was 25% of his investment; his investment was 80% of the firm's loss. Find the loss of the firm.

39. A load of coal, costing $46.50, was sold at $9\frac{2}{3}\%$ below cost. Find the selling price.

40. Snyder bought a house for $1370, and sold it to Byrne at a gain of 19%. Byrne sold it to Fuller at a loss of 8%. How much did Fuller pay for the house?

41. John Adams bought 72 yards of cloth at $8 per yard and sold it at a gain of $158.40. Find the rate % of gain.

42. A speculator sold a quantity of flour for $828. He paid $920 for it. Find his rate % of loss.

43. B bought 6 bushels of chestnuts at $4.50 per bushel, and sold 4½ bushels of same at $8.50 per bushel, and the remainder at $5.25 per bushel. What was his rate of gain?

44. How much does a carriage dealer lose by selling a carriage that cost $210 at a loss of 17%?

45. B bought a bond for $1280 and sold it for 42% more than he paid. Find his gain.

46. Jones gained 25% by selling a cow for $30 and lost 18% by selling another for $20.50. Did he gain or lose and how much on the two cows?

47. Johnson bought 45 sheep at $2.50 each. He sold 10 at a gain of 12%; 12 at a gain of 15%; 14 at a gain of 20%; the remainder at a loss of 34⅜%. How much did he gain and what % did he gain?

48. A grocer bought eggs at 27 cents a dozen and sold them at the rate of 8 for 25 cents. What % profit did he make?

49. White sold a horse to Ellis at a gain of 25%. Ellis sold the horse for $75, which was 16⅔% less than the sum he paid. How much did the horse cost White?

50. A stock of goods were bought for $1840; ¼ of the stock was sold at 21% profit; ½ of the remainder at 24% profit; the remainder at 12% loss. Find the total amount received for the stock.

51. 25 yards of cloth were bought for $187.50. At how much per yard must it be sold to gain 20%; at how much per yard to lose 12%?

52. A and B each lost $500 which was 12⅞% of A's and 13¼% of B's money. Which had the more money and how much?

53. How much is gained by purchasing 5 carloads of wheat,

of 940 bushels each, at 62½c per bushel and selling 40% of it at a gain of 12½% and the remainder at a gain of 7½%?

54. I sold a bill of goods for $360 and lost 20%. Had I sold 60% at 20% profit and the remainder at 12½% profit, what would I have gained?

55. A merchant sold a bill of goods for $750 and lost 6¼%. What ought they to have been sold for to gain 8%?

56. A stationer bought 3 gross of penholders at $5 per gross and retailed them at 5 cents apiece. What % profit did he make?

57. A contractor received 25 cents a yard for excavating a cellar. He paid his laborers 21 cents a yard. What % profit did he make?

58. Sold a horse at a gain of 33⅓% and with the proceeds bought another horse, which I sold for $120 at a loss of 20%. What did the first horse cost me?

59. A merchant's asking price is 25% above the cost. If he allows a customer a discount of 12% from the asking price, what per cent. profit does he make?

60. A merchant gained this year $1800 which was 120% of his gain last year and that was 44⅘% of his gain the year before. What were his profits for the three years?

61. Sold pork at an advance of 12½%; invested the proceeds in pork again, and sold this lot at a profit of 16⅔%, receiving $4627.50. How much did each lot of pork cost?

62. A broker bought a quantity of wheat at $1.12½ per bushel and sold the entire lot at $1.19¼ per bushel. What % profit did he make?

63. A drover bought 15 horses at $125 per head; and sold 2 of them at $127.75 per head, 8 at $140 per head, and the remainder at $150 per head. If his expenses in taking them to market were $5 per head, what was his gain per cent.?

MARKING GOODS

265. In *Marking Goods*, merchants usually resort to some device or characters to conceal the cost and selling price from the customer.

The common method in marking goods is to use a word, phrase or sentence of ten different letters, to represent the nine digits and cipher, as a private mark. Characters other than letters are also frequently used.

266. The *Key* is the word, phrase or sentence used to represent the nine figures and zero. An extra letter is used to prevent the repetition of a letter, and this is called a *repeater*.

The cost price is usually written above a horizontal line and the selling price below. Fractions may be represented the same as whole numbers.

267. Suppose our key is:

```
1   2   3   4   5   6   7   8   9   0   repeater.
c   h   r   i   s   t   o   p   e   n   x
      cost  $3.18                      r. cp.
```
Goods which and ——— would be marked ———
```
      sell for $4.46                    i. xt.
```

In the following problems the quantities considered and methods of solution are the same as those in Profit and Loss.

1. My key is "He saw it run." If I pay $4.80 per yard for cloth, how must I mark it to gain 20%?

2. Mark the cost and selling price from the key "Now be sharp," the cost being $1.40, and selling price at a gain of 30%.

Mark the cost and selling price of the following from the key "You mark his."

3. Cost $40, sold at a gain of 35%.

4. Cost $1.25, sold at a loss of 20%.

5. Cost $2.60, sold at a gain of 15%.

6. Cost $90, sold at a gain of 45%.

7. Cost $9.50, sold at a gain of 60%.

8. Cost $13.50, sold at a gain of 52%.

9. Knives bought at $4.50 per dozen, are sold at 35% profit. From the key "Charleston" mark the cost and selling price of each knife.

10. A merchant bought boots at $37.50 per dozen pairs. He sold them at retail at 40% profit. Mark the selling price from the key "Importance."

11. Caps bought at $18.75 per dozen, are sold at retail for 40% more than cost. Mark the cost and selling price from the key "Market sign."

12. Mark the selling price of collars, bought for $2.70 per dozen and sold at 60% gain, from the key "The big four."

13. Mark the selling price of goods that cost $1.46, and sold at a gain of 45%. Use the key "He saw it run."

14. Goods marked from the key "Cash profit," were sold at a gain of 40%. The gain was a.st. What was the cost and selling price?

15. I sold goods, marked from the key "Charleston," for o.cn, and gained h.en. What was my rate of gain?

16. I sold goods marked from the key "Hard moneys" for d.he, and gained 10%. Find the cost and gain.

17. Broadcloth cost $2.40 per yard, and is sold at a gain of 25%. Mark the cost and selling price from the key "Importance."

18. Goods marked from the key "Importance" were sold at a profit of 25%. The gain was p. re. What was the cost and selling price?

19. Mark the selling price of shoes, bought at $4.25 and sold at 33⅓% profit, from the key "Gambolines."

20. A merchant bought caps at auction at $10 per dozen. How will he mark the selling price to gain 20%, from the key "Blackhorse?"

21. By selling an article at $15 per dozen I gain 20%. How should I mark the cost of each article from the key "Cash profit?"

22. A dealer bought 12 chairs for \$12.50 and sold them at 20% profit. How will he mark the selling price, by the key "God help us?"

23. A merchant buys boots at auction at \$37.50 per dozen pairs. How shall he mark each pair by the key "Market sign" in order to gain 25%?

TRADE DISCOUNT

268. *Trade Discount* is an allowance or deduction made by merchants or manufacturers from their list or marked price.

In issuing price lists and catalogues it is customary with manufacturers and large dealers to establish a fixed price, above the usual market price, and then meet the fluctuations in the market price by giving discounts, greater or less, from this established price.

269. The *List Price* or *Invoice Price* is the face of the bill before the discount has been deducted.

270. The *Net Price* is the selling price or the list price less the discount.

271. *Cash Discount* is a certain per cent. deducted for payment of a bill immediately, or within a limited number of days.

Thus upon the bills of a wholesale merchant may be seen the following: Terms: "4 months, 30 days less 5%" or "30 days, 2% off 10 days," which means that purchasers are entitled to a credit of 4 months but will be allowed 5% discount if bills are paid within 30 days, etc.

272. The bill from the jobber or manufacturer frequently bears two dates; a shipping date and a date from which sales commence. The jobbing and manufacturing business is from six months to a year ahead of the wholesale and retail trade. Goods so sold and billed are frequently paid for before the arrival of the selling date and if paid for before that date an additional discount is deducted. This is called anticipating a bill, the rate is usually the current rate of interest.

273. When more than one discount is given, the first is reckoned upon and deducted from the list price, the others are deducted from the successive remainders.

The order in which the discounts are deducted does not affect the result. Thus a discount of 25%, 10% and 5% is the same as 10%, 5% and 25%.

274. It must not be supposed that several separate discounts are equal to their sum. This is not the case because they are not

computed upon the same base. Thus 25% and 10% is not the same as 35%.

In computations in Trade Discounts list price = Base.

275. *To find the net amount of a bill when discounts are allowed.*

ORAL PROBLEMS

1. Find the net in the following single discounts: 90%, 85%, 75%, 66⅔%, 50%, 87½%.

2. Find the net in the following double discounts: 10 and 10%, 25 and 20%, 20 and 20%, 20 and 10%, 33⅓ and 10%.

3. What is the net price of a piano listed at $300 subject to a discount of 10%? 25%? 30%? 12½%? 20 and 25%? 10 and 10%? 33⅓ and 10%? 50 and 10%? 25 and 20 and 10%?

4. I bought a bill of hardware amounting to $120, subject to a discount of 33⅓% and 10%. What is the net?

5. A merchant paid $36 for an article which he sells at an advance of 33⅓%. What must be the asking price if he allows a discount of 25%?

WRITTEN PROBLEMS

1. A bought a bill of goods amounting to $125. He is allowed 20% and 10% off, and 5% off for cash. What amount of cash will pay the bill?

SOLUTION	Or.	
1. 100% − 20% = 80%	$125	
2. 90% of 80% = 72%	25	= 20% discount.
3. 95% of 72% = 68⅖%	$100	after first discount.
4. 100% = $125.	10	= 10% discount.
5. 1% = $1.25.	$90	after second account.
6. 68⅖% = $85.50.	4.50	= 5% discount.
	$85.50	net.

From the foregoing solution and explanation we have the following:

To Find the Net Amount of a Bill

a. Find the net amount of 100%.

b. Let 100% equal the face of the bill.

c. Find the value of 1%.

d. Find the value of the net amount of 100%.

NOTE.—The net amount of a bill may also be found by computing each discount separately and subtracting.

2. I was allowed 35% discount on a bill of $780. Find the net amount of the bill.

3. J. W. West sold a bill for $112.50 on 30 days time. He accepted cash payment at a discount of 14%. Find the discount allowed.

4. A. M. White bought a reaper for $218.40 on 6 months time, or 12½% off for cash. He paid cash. What discount was allowed?

5. Find the net cost of a bill of $187.26 at a discount of 16⅔%.

6. Smith bought an overcoat, marked at $19.20, at a discount of 17½%. What did it cost him?

7. Shoes, which were marked $6.40, were sold at 12½% less than the marked price. How much was received for them?

8. A merchant allowed me 4⅕% discount on a hat, marked at $2.65. How much did the hat cost me?

9. A dealer bought a lot of coffee for $360, at a discount of 20 and 10%. What was the net cost of the coffee?

10. What single discount is equal to a discount of 25%, 10% and 5%?

NOTE.—Find the net amount of 100% and subtract this from 100%.

11. A discount of 10 and 5% is allowed on a bill of $450. Find the net cost.

12. Owens sold Moore clothing amounting to $234.50, at a discount of 20 and 12½%. What was the net cost?

13. Find the net cost of an invoice of $312.90, at a discount of 15 and 5%.

14. B bought dry goods at a discount of 15, 10 and 6%. The amount of the bill was $520. Find the net cost.

15. I was allowed a discount of 30, 20 and 10% on an invoice of books amounting to $84. How much did I pay for the books?

16. Howard sold a bill of notions for $760, with 25, 13⅓ and 8% off for cash. How much cash did he receive?

17. How much must I ask for goods that cost $20, that I may gain 20% and allow 20% off from marked price?

Let 100% = the cost $20, 1% = $.20, 120% = $24 = selling price, or 80% of marked price. If 80% of marked price = $24, 1% of marked price = $.30 and 100% or marked price = 100 × .30 = $30.

18. Find the marking price of goods that cost me $30, that I may gain 20% and allow 25% discount from the marking price.

19. A gained 25% on goods that he sold for 40% discount. The goods cost him $12. How much did he ask for the goods?

20. B sold me a bill of goods that cost him $8.40, at a discount of 19½%. He gained 15%. How much did he ask for the goods?

21. What must be the marked price of goods that cost $5.80, that the seller may allow 5¾% off and still make a gain of 30%?

22. The cost of a pair of shoes was $1.12. The seller gained 45%, and allowed a discount of 20%. What was his marked price from the key "Christopen?"

BILLS

276. A *Bill* is a written statement of merchandise sold, or services rendered. It should contain the date and place of purchase, names of the buyer and seller, and each article with the prices, terms and total cost.

277. An *Item* is a single article with price and amount, as given in a bill or statement.

278. An *Invoice* is a statement rendered by a wholesale dealer, or an account of goods imported. The term *invoice* usually refers to larger quantities of goods than the term *bill*, but the terms are often used interchangeably.

279. A *Statement* is a copy of an account showing the date and amount of each bill and also the balance carried down from the last preceding statement.

280. A *Duplicate Bill* or *Invoice* is a copy of the original bill. It should always be marked *Duplicate* across its face.

To receipt a bill the seller writes below the items the words *Received Payment* and signs his name. If this bill is receipted by a clerk, who may be authorized to perform such duties, he should sign *Per* his own name or initials immediately beneath that of his principal.

No. 1

CHICAGO, JUNE 18, 1905.

GEORGE ADAMS,

Bought of AMOS BROWN & CO.

3	bbl. Minn. Flour	$7.00		
5	bu. Potatoes	.80		
25	lb. Granulated Sugar	.05		
10	" Japan Tea	.65		
2	box Florida Oranges	4.00		

Received Payment,
AMOS BROWN & CO.
Per Davis.

281. Signs and Abbreviations Used in Bills, Statements, Etc.

a|c or *acct.* account.   *C. O. D.* collect on de- *prox.* next month.
@ at or to.   livery.   *ult.* last month.

Amt. amount.	*Cr.* creditor.	*Mdse.* merchandise.
bal. balance.	*Dr.* debtor.	*Pd.* paid.
Bo't bought.	*E.* and *O. E.* errors and	*Rec'd Paym't,* received
B|L bill of lading.	omissions excepted.	payment.
Co. Company.	*F. O. B.* free on board.	*Sunds.* sundries or sev-
ctg. cartage.	*int.* interest.	eral.
contra. contrary or op-	*inst.* present month.	#number or pounds.
posite.		

No. 2

Folio 172.   WORCESTER, MASS., May 1, 1905.

Sales Book 345.

RICHMOND BROS.   *Bought of* A. B. DICKINSON & Co.

Terms Interest after 60 days; 2% discount, 30 days.

Case			No. Yd.	Price	Items	Amount
#23	12	Pieces Bleached Cotton, 40^1 43^2 41^1 42^3 46 47^1 45^3 46^2 44^1 40^3 41^3 43^3		$.06\frac{1}{3}$		
#5	15	Pieces Muslin, 33^1 32^2 31^3 30^1 33^2 32^1 31^2 34 33^3 31^2 34^3 33 35^1 32^3 35^1		.07		
#7	21	Pieces Windsor Prints, 23^3 20^1 21^2 22^1 24 23^2 21^3 22^2 24^2 25 24^1 23^1 20^2 21^2 25^1 24^3 20^3 23^2 21 25^3 26		.05		
#32	16	Pieces Merrimac Prints, 30 31^1 32^2 33^3 29^1 27^3 28^2 30^1 29^2 24^2 27^2 26^1 29^3 30^2 31^2 33		$.04\frac{1}{2}$		
#11	6	Pieces Delaine, 39^1 40 39^3 42 41^1 40^3		.15		

Extend all amounts. What was the cost if paid in 60 days; if paid in 30 days; if paid in cash with 2 and 2% off?

(The small figures at the right represent fourths—40^1 is $40\frac{1}{4}$ yd.)

No. 3

Folio 123.
Sales Book 291.
MR. M. I. PETERSON,
Terms Cash.

Bought of CLARK BROS.

380	yd. Body Brussels	@ $1.20				
710	yd. Tapestry "	@ .92				
190	yd. Moquette "	@ 1.45				
500	yd. 3-ply Ingrain	@ .65				
310	yd. 2-ply "	@ .48				
220	yd. Matting	@ .22				
250	yd. Lining	@ .11¼				

Find what will pay the bill with 4 and 4% off.

No. 4

Folio 367,
MR. G. H. BROWN,

Bought of JACKSON BROS.

Terms 30 days, 10 days 3% discount, Cash 3 and 2½% discount.

2	Bbl. ²⁵ Prunes 240–20 220 270–20 250 470 @ .06	28	70		
3	Bbl. ²⁵ Rice 212–19 * * * 219–20 * * * * * * @ .08¾ 220–20 * * *				
4	Bbl. ²⁰ "A" Sugar 311 300 297 288 @ .08½				
5	Bbl. ²⁰ "G" Sugar 300 287 310 303 295 @ .07				
2	Bbls. ²⁵ Cut 260–18 * * * Loaf Sugar * * * @ .10 252–17 * * *				
3	Bbl. ²⁵ "C" 310–18 * * * Sugar 320–20 * * * * * * @ .09 212–19 * * *				
	Cartage	2			

What sum will pay this bill at the end of 30 days; at the end of 10 days, in cash when purchased?

(The small figures at the right of "Bbl.," are the price of the same. 1st item 240-20, means that the gross weight was 240℔., allowance (tare) 20℔., net weight 220 ℔. The 2d, 5th and 6th items are same as 1st.)

No. 5

Book 4, Page 411.   SOUTH OMAHA, NEB., MAY 2, 1905.

MESSRS. J. C. OLIVER & SON,

Bought of L. B. SMITH,

Terms, 60 days, 5% off 10 days, 4 and 2% for cash.

			No. Lb.	Price	Items		Amount
	6	Basket Pork Loins 310 313 308 296 301 299		.07			
	4	Tubs Lard 68 71 69 70		.08½			
	3	Casks Shoulders 420 429 427		.07½			
	7	Bbl. Mess Pork		$17.40			
	11	Casks Hams 389 387² 401² 403 392 397³ 400² 398 397 402 400		.11			

Find what sum will pay the bill on July 1; on May 12; on date of purchase.

No. 6

LYNN, MASS., JUNE 2, 1905.

MR. C. B. ACKERS,

Bought of P. T. BUTLER & CO.

Terms 60 days.

# 271	1½	doz. pr. Buff Oxford Shoes	@ $1.30			
#2710	6	doz. pr. Ladies' L. B.	@ 1.40			
#4231	4	doz. pr. Ladies' K. S. B.	@ 2.25			
#1161	5	doz. pr. Farmers' K. Boots.	@ 3.20			
		4% off				
#3210	3	doz. pr. Farmers' C. P. Boots	@ 3.00			
# 769	4	doz. pr. Boys' Stoga Boots	@ 1.90			
#1279	2½	doz. pr. Kid Brogans	@ 2.25			
#2128	2	doz. pr. Kip Plow Shoes	@ 1.85			
		5% off				
#3670	3	doz. pr. Custom Kip Boots	@ 2.10			
#2737	2	doz. pr. Men's Thick Boots	@ 3.10			
		3% off				

How much cash will pay this bill with 3 and 5% off?

No. 7

SAGINAW, MICH., JAN. 23, 1905.

MESSRS. D. C. WILSON & CO.

Bought of L. B. WRIGHT & CO.

Terms, Sight Draft after 60 days; 5% off if paid within 10 days.

128640 ft.	Pine Plank	$21.60 per M.		
33245 ft.	Clear Pine	26.80 per M.		
76898 ft.	Clapboards	24.20 per M.		
23840	Cedar Posts	7.00 per C.		
29300	Shingles "A"	3.80 per M.		
33400	Shingles "B"	3.00 per M.		
49800 ft.	Pine Timber	19.00 per M.		
96384	Cedar R. R. Ties	27.00 per C.		
79360 ft.	Flooring	24.91 per M.		
29200 ft.	Barn Boards	12.60 per M.		

What is the amount of the above bill, if paid March 10, 1905; if paid Feb. 1, 1905?

(M. means by the 1000; C. by the 100.)

No. 8

CHICAGO, ILL., SEPT. 26, 1905.

MESSRS. BRUNER & SON,

Bought of H. B. SILVER & CO.

Terms, 90 days, 4% off, 10 days.

15	F. Base Burners	@ $27.50		
12	K. Ranges	@ 30.00		
18	Cook Stoves	@ 23.50		
12	Cook Stoves	@ 14.00		
8	Kegs Nails "10's" 100# each	@ .05		
6	Kegs Nails "8's" 100# each	@ .05½		
2	doz. Sets Knives & Forks	@ 1.20		
3	doz. Sets Silver Spoons	@ 3.60		
4	doz. Tack Hammers	@ 1.10		

What is the amount of the bill? What if paid within 10 days? What if paid Oct. 4, 1905, and 4 and 3% are allowed?

No. 9

NEW YORK, JULY 6, 1905.

MR. D. B. WARD,

Bought of AMERICAN BOOK CO.

Terms, 30 days.

18	New Practical Arithmetic	@ $ .68	
24	" Primary "	@ .42	
30	Lessons in Grammar (Welsh)	@ .60	
12	Eclectic Geography	@ 1.20	
36	Wright's Spellers	@ .26	
18	Word Analysis (Swinton)	@ .35	
12	Wright's Alternate Reader	@ .80	
12	" First "	@ .20	
12	" Second "	@ .28	
12	" Third "	@ .40	
	Less 10%		
24	Loomis' E. Algebra	@ .55	
18	" C. "	@ .85	
6	Wentworth's Geometry	@ 1.12	
12	Harkness Latin Grammar	@ 1.12	
12	" " Reader	@ .60	
12	Rice's Book-keeping	@ 1.60	
24	Barnes' Brief History, U. S.	@ .90	
	Less 20%		
	Cartage		1	70

What will the above cost at 4% discount?

No. 10

Folio 828.   GRAND RAPIDS, MICH., FEB. 14, 1905.
MR. J. B. HINMAN,

Bought of B. M. WESTON & CO.

Terms, 30 days.

12	Bedroom Sets		@ $31.50	
		6% off		
20	Parlor Sets		@ 42.00	
		10% off		
6	Walnut Sideboards		@ 16.00	
		4% off		
15	Walnut Dining Tables		@ 12.00	
		5% off		
12	Round Tables		@ 8.00	
		2½% off		
10	Cherry Book Cases		@ 13.50	
		3% off		
18	Easy Chairs		@ 3.20	
12	Patent Rockers		@ 5.00	
		4% off		
22	Baby Carriages		@ 6.00	
		5% off		

Find the cost of the above at 10 and 2½% off.

No. 11

MR. A. B. CUMMINGS,

Bought of R. K. MEYERS & CO.

Terms, April 1, 1906, 60 days, 2% off 10 days.

			No. Yd.	Price	Items	Amount
#47	8	Pieces Merrimac D. Prints, 32 31^2 33^1 29^3 30^1 31 30^3 32^1		.05		
#30	11	Pieces Gingham, 34^1 33^2 32^3 31 31^3 34 33^1 30^3 31^2 32 33		.10		
#26	14	Pieces Cotton Flannel, 36 35^2 37^1 36^3 37 38 37^3 36^2 35^3 36^1 37^2 35^1 34^3 35		.14		
#9	10	Pieces Cottonade, 33 32^1 31^2 33^3 30^1 34 29^3 33^2 32^2 32^3		.19		
#13	6	Pieces Irish Linen, 37 37^1 36^2 36 37^2 35^3		.32		
#7	3	Pieces Brown Duck, 35 34^3 35^1		.12		

How much will pay the bill April 20, 1906? How much will pay the bill on April 6, 1906?

No. 12

MESSRS. CLARK & CHIDESTER,

Bought of A. BOOTH & CO.

Terms, net cash 30 days.

2	Qtl. New Geo. Cod		$ 5.75	
3	bbl. Ex. #1 Mackerel		22.00	
10	Kits 15 lbs. Ex. #1 "		1.80	
10	" 20 " Bay #1 "		1.80	
2	bbl. #2 Shore " lg.		11.75	
15	Kits 20 lbs. #2 shore "		1.55	
8	Halfs New Labrador Herring		3.67	
7	" Round Shore "		$3.12\frac{1}{2}$	
	Box .25, Ctg. .80			

No. 13

MEYER VALVE CO.
Steam, Brass and Iron Goods.

CHICAGO, July 29, 1905.

Your Order No. 1463.
Our Order No. 9463.
Terms: 10 da. 2%; Net 15 da.

2	½ Pt. SC Zero Lub.	Net $3.05			*·**
2	1 " " " "	" 4.25			*·**
12	Filling Plugs for ½ Pt. SC				
	Zero Lub.	.35	*·**		
	20%		·**	*·**	
12	¼ Coil Pipe Syphon	.50	*·		
	63–10–10%		*·**	*·**	
13	1¾ Eng. Tav Flue Cleaners	2.00	**·		
	80–10–10%		**·**	*·**	
1	2" Roller Tube Expanders	10	**·		
	70–7½–10%		**·**	*·**	
2	2" Spring Tube Expanders	12.00	**·		
	50–5%		**·**	**·**	

COMMISSION

282. *Commission* is a compensation allowed a person who buys or sells goods or other property for another.

283. An *Agent* is a person authorized to transact business for, and in the name of another.

284. The *Principal* is the person for whom an agent transacts business.

285. A *Commission Merchant* is a merchant who buys or sells goods, produce, live stock or other property, as an agent for others.

286. A *Consignment* is a quantity of goods sent to a commission merchant to be sold on commission.

287. The *Consignor* is the person who sends the goods.

288. The *Consignee* is the commission merchant or person to whom the goods are sent.

Commission is commonly estimated at a certain per cent. of the amount of the sale or purchase. This rate per cent. varies according to the agreement of the parties or the customs of business, and is not fixed by law.

Commission merchants are by the customs of business responsible to their principals, for the value of goods sold by them on credit. No separate rate per cent. is charged for assuming this liability, but the rate of commission is made large enough to cover it. In this respect commission merchants differ from other agents.

289. The *Net Proceeds* of a sale or collection is the amount remaining after the commission and other charges have been deducted.

290. An *Account Sales* is a statement rendered by the commission merchant to his principal after the property has been sold, showing the amount of sale, commission and other charges, and the net proceeds.

291. A *Remittance* is a term applied to the money (usually

a draft), sent by the commission merchant to the principal in payment of the net proceeds.

292. An *Account Purchase* is a statement rendered by a commission merchant after goods have been bought, showing the cost, charges and commission, and the total or entire cost.

293. The *Entire Cost* is the sum of the purchase and charges.

The commission is computed on the amount of purchase or the amount of sale.

When money is received, to be invested, the amount received includes the commission.

294. In computations in Commission.

1. Amount of sale or amount of purchase = Base.

2. Commission = Percentage.

3. Entire cost = Amount.

4. Net Proceeds = Difference.

1. Find the commission at 2% on the following sales: $75, $64, $375, $120, $320 and $525.

2. Find the commission at 2½% on the following sales: $80, $240, $280, $3.60, $4.80, $1200 and $150.

3. After a commission of 3% is deducted from the following sales, what will be the net receipts: $75? $120? $24? $60? and $160?

4. A commission merchant receives a commission of $40 for selling some wheat. What did the sales amount to if the rate of commission was 2%? 2½%? 4%? 5%?

5. Find the net proceeds in the following, sales $200, rate of commission 5% and various charges $15.

6. A commission dealer reports the following sales, $360. Find net proceeds, rate of commission 2% and $10 charges; 2½% and $12; 3% and $18?

295. WRITTEN PROBLEMS

1. What commission is received for selling $1250 worth of goods at a commission of 7%?

SOLUTION

Or,

1. $100\% = \$1250.$
2. $1\% = \$12.50.$
3. $7\% = \$87.50.$

$$\begin{array}{r} \$1250 \\ .07 \\ \hline \$87.50 \end{array}$$

From this solution we deduce the following:

To Find the Commission

a. Let 100% equal the amount of sale or purchase.

b. Find the value of 1%.

c. Find the value of the given rate.

Or, Multiply the amount of sale or purchase by the rate per cent. expressed decimally.

NOTES.—To find the net proceeds subtract the commission from the amount of sale.

2. To find the entire cost add the commission to the amount of sale.

2. My agent charged 5% commission for buying merchandise worth $370. Find his commission.

3. I bought goods amounting to $640 for A, and received $4\frac{3}{4}\%$ commission. How much did I receive?

4. B paid his agent $6\frac{1}{2}\%$ for buying goods. What was the agent's commission on a bill of $39.50?

5. The amount of sale was $172.50. Find the agent's commission at $3\frac{1}{3}\%$.

6. White sold goods to the amount of $28.72 for me. I allowed a commission of $9\frac{1}{4}\%$. Find the commission.

7. How much commission at $7\frac{1}{8}\%$ is received on a sale of $1282.40?

8. A commission merchant sold 185 bbls. of apples at $5.20 per bbl., at a commission of $4\frac{1}{2}\%$. Find the amount of commission.

9. An agent received $3\frac{1}{4}\%$ commission for selling 90 boxes of shoes at $12.70 per box. What was his commission?

10. My agent bought 170 boxes of kid gloves at $8.40 per box. How much is due him if he charges $2\frac{3}{4}\%$ for buying?

11. A's agent in New York paid $1460 for goods and charged 3% for buying and $2\frac{2}{3}\%$ for insurance. How much did the goods cost A?

Note.—Since he charged 3% for buying and 2⅔% for insurance, the goods must have cost 105⅔% of the original cost. 1% of the original cost is one hundredth of $1460, or $14.60, and 105⅔% of the original cost is 105⅔ times $14.60 or $1538.84, the entire cost.

12. I sold $1820 worth of goods for Brown, and charged him 3½% for selling. Find the amount which was due him.

13. The invoice price of goods was $470, the agent's charges for buying were 5½%. Find the entire cost.

14. A commission merchant bought eggs to the amount of $128.50 for Brown at a commission of 7¾%. What did the eggs cost Brown?

15. An agent sold 610 bushels of corn at 30 cents per bushel. He charged a commission of 4%. Find the net proceeds of the sale.

16. A grain dealer sold through a commission merchant 1000 bushels of wheat at 84³⁄₁₀ cents per bushel. He allowed 2⅔% commission. Find the net proceeds.

17. I paid an agent $24.60 for selling a quantity of flour, at a commission of 4%. Find the amount of the sale.

Note.—Since 4% of the amount of the sale is $24.60, 1% of the amount of the sale is one-fourth of $24.60 or $6.15 and 100% (the amount of the sale) is 100 times $6.15 or $615.

18. A received $36.48 commission for buying goods for Graham. How much did the goods cost, if the commission was 3%?

19. An agent's commission at 2½% was $27.50. Find the amount of the bill purchased.

20. Jones paid me $18.56 for buying wheat. How many bushels did I buy at 80 cents per bushel, if my rate for buying was 2⅔%?

21. A commission merchant received 7⅜% for selling. He received $73.20 commission on a sale. Find the amount of the sale.

22. My agent sold 40 cases of boots at $21.20 per case, and charged 3⅝% for selling. Find the amount the agent should remit to me.

23. What is the selling price, if the commission is $11.48, the rate being 1¾%?

24. I charged 4% for selling some sheep, and received $37.80. How many sheep did I sell at $3.78 per head?

25. I shipped to a commission merchant 140 bbls. of potatoes and 95 bbls. of flour. He sold the potatoes at $2.25 per bbl., and the flour at $8.50 per bbl. He charged 4% for selling and 2% for storage. Find net proceeds.

26. Find the amount of purchase, if the entire cost including 3% commission is $309.

Note.—Since $309 is 3% more than the amount of purchase, it is 103% of the purchase, 1% of the purchase is $\frac{1}{103}$ of $309 or $3, and 100% (the purchase) is $100 \times \$3$ or $300.

27. An agent remits $380, after deducting his commission of 5%. What was the amount of sales?

28. The entire cost was $676, the rate of commission 4%. Find the amount of purchase.

29. I sent my agent $341.25 to invest in hogs at a commission of 5%. How many hogs can he buy at $3.25 per head?

30. B received $186.30 to invest in oats at 30 cents per bu. He deducts his commission of $3\frac{1}{2}$%. How many bushels did he buy?

31. A farmer received $164.90 as the proceeds of the sale of 85 bbls. of apples. For how much per bbl. did the apples sell, the commission being 3%?

32. A commission merchant sold 115 bu. of wheat at 90 cents per bu., 240 bu. of oats at 32 cents per bu., and 665 bu. of rye at 80 cents per bu. His charges were 3% for selling, $24 for storage, $9.65 for drayage, $15.80 for demurrage. What amount should he remit to the consignor?

33. A commission merchant received $16.74 for selling 465 bu. of wheat. For how much per bu. did he sell the wheat if his rate for selling was 3%?

34. A commission merchant charged $2\frac{5}{8}$% for selling and $6.35 storage. He remitted $500 to the consignor. Find the amount of the sale.

35. What is the selling price of a house, if the rate for selling is $8\frac{1}{3}$% and the proceeds are $880?

14

36. White remitted his agent $624, with instructions to buy potatoes at 40 cents per bu., after deducting his commission of 4%. How many bushels can he buy?

37. An agent charged $14.40 for buying an invoice of goods amounting to $320. What was his rate of commission?

Note.—Since the cost $320 is 100%, $1 is $\frac{1}{320}$ of 100% or $\frac{5}{16}$% and $14.40 is 14.4 times $\frac{5}{16}$% or $4\frac{1}{2}$%.

38. A commission merchant charged $20.50 including $7 for storage, for selling a bill of $450. Find his rate of commission.

39. Lyman purchased through an agent $218.75 worth of silk. The agent charged $8.75 for buying. What rate % did he charge for buying?

40. The entire cost was $981.82½, and the commission was $55.57½. Find the rate of commission.

41. B's agent in Boston bought for him 220 pairs of boots at $2.60 per pair, and 72 pairs of slippers at $1.15 per pair. His commission was $5\frac{1}{3}$%; he paid 2% for insurance, $33.25 for freight, $7.80 for drayage. How much did the goods cost B?

42. An agent's charges including $35 for freight, were $78.50, and his rate for buying was $5\frac{1}{2}$%. Find the amount of purchase and the entire cost.

43. B collected 60% of a debt. His charges were $9.60. What was the whole debt, if he charged $1\frac{1}{2}$% for collecting?

44. The entire cost of an invoice of clothing was $298.75 including $8.25 for freight and $3\frac{3}{4}$% for buying. Find the net cost of the invoice.

45. A commission merchant remitted $358 to the consignor after he had deducted the following charges: 5% for selling, 2% for insurance, $4.70 for cooperage. What was the selling price of the goods?

46.   ## Account Sales

Sold for account of J. C. SAMPSON & Co.

By THOMAS W. BANNING.

190—							
Oct.	3	50 bbl. XX Flour	6.25	312	50	
		100 " Minn. Flour	5.75	575		
"	10	100 " XX Flour	6.30	630		
		100 " Minn. Flour	5.80	580		
		Charges.				
Oct.	1	Freight $67.50 and Cartage $15.60		———	——	
"	10	Storage 350 bbl. @ 3c		———	——	
"	10	Insurance ₁½%		———	——	
"	10	Commission 5%		———	——	
		Net Proceeds				

Put the following narratives in the form of Account Sales:

47. William C. Davidson, Kansas City, Mo., sold for account of Marshall Field & Co., Chicago, the following goods: 1905 Aug. 4, 8 pc. Summer Silk, 294 yds. @ $.72; Aug. 13, 5 pc. Black Silk, 216 yds., @ $1.48; Aug. 17, 16 pc. Calico, 876 yds., @ $.07; Sept. 3, 19 pc. Alpaca 548 yds. @ $.34; Sept. 10, 25 pc. Diagonals, 587 yds., @ $.65. The charges are: Aug. 1, Freight and Cartage, $67.38; Insurance, ½%; Commission, 5%. Find the net proceeds.

48. E. P. Ellwood & Co., Chicago, sold for account of Thomas Mason the following: 1905, Nov. 1, 300 bu. Potatoes, @ 48c; Nov. 3, 100 bu., @ 52c; Nov. 10, 60 bu., @ 58c; Nov. 16, 200 bu. at 56c; Dec. 1, 230 bu. at 57c. The charges are: Nov. 1, Freight, $86.35; Cartage at 2c per bushel; Storage at 3c per bu.; Commission, 5%. Find the net proceeds.

49. ## Account Purchase

Bought for account of DAVID ANDERSON & CO.,
By HENRY HAMMOND.

68	yd. Fancy Prints	.12			
42	" Colored Silk	$1.38			
¾	doz. Ladies' Felt Hats	$24.00			
18	yd. Black Cassimere	$1.40			
3	suits Boys' Clothes	9.00			
	Charges.				
	Packing and Cartage		1	50	
	Commission 5%				
		Entire Cost			

Put the following narrative into the proper form of Account Purchase:

50. A. B. Duncan, St. Louis, bought for account of Davis & Norse the following: 1905, March 18, 150 bbl. Dakota Flour @ $5.80; 80 bbl. Buckwheat Flour @ $12.30; 480 bu. Ground Feed @ 30c; 500 bu. Bran @ 8c; 20 bbl. Superfine Flour @ $7.30; Cartage, $7.80; Commission, 5%. What is the entire cost?

51. A merchant in Peoria shipped to his broker in Chicago a car lot of potatoes, 967 bu., which were sold at 64c per bushel. What was realized on the sale if the broker charged 5% for selling and freight cost 4c per 100 lbs.? How many pounds of Golden Rio coffee could be purchased with the proceeds of the sale of potatoes if coffee is worth 12c per pound and the broker charges a commission of 3% for buying?

INSURANCE

296. *Insurance* is a security guaranteed by one person or company to another, against loss or damage.

The several kinds of insurance derive their names from the kinds of risks assumed ; thus we have Fire Insurance, Marine Insurance, Life Insurance, Health Insurance, etc.

There are several other minor forms of property insurance, such as *Live Stock Insurance, Tornado Insurance, Steam Boiler Insurance, Plate Glass Insurance, etc.*, the nature of which is indicated by their names.

297. *Accident Insurance* is security against loss or damage by accident in traveling.

298. *Life Insurance* secures a certain sum to a person's heirs in case of death.

299. *Health Insurance* secures an allowance during sickness.

300. *The Insurer* or *Underwriter* is the party who agrees to make good the loss or damage.

301. The *Insured* is the person secured against loss or damage.

Insurance is usually conducted by companies organized for the purpose and these may be classified as *Stock Companies* and *Mutual Companies.*

302. A *Stock Company* is one, the capital of which is owned by individuals called stockholders, who alone share the profits and losses.

303. A *Mutual Company* is one in which the insured becomes a sharer in the losses and gains of the company.

Some companies combine the principles of *Stock* and *Mutual Companies* and are termed *Mixed Companies.*

304.. *The Policy* is the written contract between the insurer and the insured. It describes the property insured, the conditions, time, rate, etc.

305. A *Valued Policy* is one in which the value of the property insured is specified.

306. An *Open Policy* is one in which the value of the property insured is to be determined after loss. This arises usually in cases of merchandise in transit, and enables merchants to insure property shipped at different times and places.

307. The *Premium* is the sum paid for insurance and is usually a certain rate per cent. on the amount insured.

The rates of premium depend upon the character of the risk, and the length of time it has to run. The rate for three years in fire companies is usually twice the rate for one year.

FIRE INSURANCE

308. *Fire Insurance* is a security against loss or damage by fire.

Fire insurance covers not only loss by fire, but also from smoke, water used in putting out a fire in an adjoining building and breakage or damage done by firemen while arresting the progress of a fire, such as blowing up a building.

Whoever owns or has an interest in property, may insure it to the full amount of his interest or ownership.

No more than the *actual loss* can be recovered by the insured, whether there be one or several insurers.

Usually property is insured for about three-fourths of its actual value.

309. *Adjustment of Losses*. Fire insurance companies, as a rule, pay the full amount of the loss, provided this does not exceed the valuation named in the policy. Some policies contain the "average clause" which requires the payment of only such a portion of the loss as the amount insured bears to the whole value of the property.

Thus, under the "average clause," if property worth $10000 is insured for ½ its value or $5000, the company will in case of loss, pay but ½ of the loss whereas without the "average clause" the company would pay the entire loss up to the limit of $5000, or the face of the policy.

In Chicago the board of underwriters have inserted an "80% clause" in policies, which exempts the policy from the "average clause" in case the insured shall carry insurance equal to 80% of the value of the property.

310. In computations in Fire Insurance,

1. Valuation = Base. 2. Premium = Percentage.

311. *To find the premium when the valuation and rate of insurance are given.*

ORAL PROBLEMS

1. What is the premium at 2% on the following: $1200, $350, $750, $3000?

2. What is the premium at 2½% on the following: $400, $150, $600, $1500, $900?

3. A's house cost $6000. What is the premium at 1½% on a three-fourths valuation?

4. I paid $4 premium for insuring household goods at 1%. What was the face of the policy?

5. What is the insurance on a building if the premium at 2½% is $75?

6. A house valued at $3200 was insured at a three-fourths valuation for a term of 3 years. What was the premium, the rate being 1½% per year?

7. If $72 is paid for insurance for 4 years, what is the policy if the rate is 2%?

WRITTEN PROBLEMS

1. A insured a house for $8400 at ¾% premium. What was the premium?

SOLUTION	Or,
1. 100% = $8400.	$8400
2. 1% = $84.	.00¾
3. ¾% = $63, the premium.	$63.00

We therefore have the following rule:

To Find the Premium

a. Let 100% equal the valuation.

b. Find the value of 1%.

c. Find the value of the given rate.

Or, Multiply the valuation by the rate per cent. expressed decimally.

2. A house is insured for $6400 at 2½%. What is the premium?

3. A insured a house for $2400 and its contents for $800 at ¾%. What was the premium?

4. A merchant insured a stock of goods worth $4500 for $\frac{2}{3}$ of their value at $2\frac{1}{2}\%$. What was the premium?

5. A building worth $28400 is insured for $\frac{3}{4}$ of its value at 3%. What is the premium?

6. What will it cost to insure a barn worth $4200 for $\frac{3}{4}$ its value at $\frac{2}{3}\%$?

7. A has $1240 worth of live stock insurance at $\frac{3}{2}\%$; store worth $5200 insured at $1\frac{1}{4}\%$; stock of merchandise worth $2700 insured at $\frac{8}{9}\%$. How much premium does he pay?

8. A house valued at $2640 was insured for $\frac{5}{6}$ its value at $\frac{8}{11}\%$, and furniture valued at $1650 for $\frac{3}{5}$ its value at $1\frac{1}{3}\%$. If the property is burned and the company pays the loss, what will be the net loss to the company?

9. I paid a premium of $72 for insuring merchandise at $1\frac{1}{4}\%$. What was the amount insured?

Note.—Since the premium is $1\frac{1}{4}\%$ and amounts to $72, $1\frac{1}{4}\%$ = $72, and 1% equals as many dollars as $1\frac{1}{4}$ is contained times in $72 or $57.60 and 100%, the amount insured, equals 100 times $57.60 or $5760.

10. Smith paid $51.75 premium for insurance on his property for $\frac{5}{8}$ its value at $\frac{9}{10}\%$. What was the value of the property?

11. If a company charges $60 for insuring a building for $\frac{3}{4}$ its value at $1\frac{3}{4}\%$, what is the amount of the policy and the value of the property?

12. A barn insured for $2850 for 5 years at 75c per annum was destroyed by fire. What was the actual loss of the company?

13. A stock of goods worth $9500 is insured for $6500, and is damaged by water while extinguishing a fire in an adjoining building to the amount of $1320. The policy contains an "average clause." What amount will the company pay?

14. A insured his stock of goods as follows: $2000 in the Ætna Insurance Company, $2800 in the Home Insurance Company, $3500 in the Essex Company, $4200 in the Phœnix Company. His loss by fire was $4375. How much will each company pay?

Note.—Find the total insurance. Find what per cent. the loss is of the total insurance. Multiply each risk by the per cent. of loss.

15. A building was insured in the Mutual Company for $2700, in the Springfield Company for $3600, in the Local Company for $4000, in the Commercial Company for $5400. A loss of $3611 was caused by fire and water. What loss was paid by each company?

16. The loss by fire and water on the Union National Bank building was $68340. It was insured as follows: Metropolitan Company $18000; Great Western Company $22000; American Company $13000; United States Company $15000; Lancaster Company $25000; Orleans Company $9000. How much of the loss is paid by each company?

17. I paid a premium of $102 for insurance on my house for $\frac{2}{3}$ its worth at $2\frac{1}{2}\%$. What was the house worth and what would be the company's net loss, if the property was destroyed?

18. I paid $124.80 for having a building worth $6800 insured at $\frac{2}{3}$ its value and its contents valued at $8200 insured at $\frac{3}{4}$ their value. What rate did the company charge for insuring?

19. A's house worth $2500 was insured for $\frac{4}{5}$ its worth, and furniture worth $3690 for $\frac{5}{6}$ its worth. The premium was $70.40. What was the rate of insurance?

20. A farmer had his horses worth $960 insured for their full value; his cows worth $1260 insured for $\frac{2}{3}$ their value; his hogs worth $822 insured for $\frac{2}{3}$ their value. What was the rate of insurance if he paid a premium of $89.46?

MARINE INSURANCE

312. *Marine Insurance* is a security against loss or damage to vessels and their cargoes by the perils of navigation.

Transit Insurance is security against loss or damage to property while in transit by railroad or water route and is a kind of marine insurance.

313. An *Insurance Certificate* is a document issued by marine insurance companies similar in nature to a policy.

Insurance certificates are negotiable and are, together with bills of lading, used by shippers as security for money advanced by banks.

314. *Policies* on cargoes are issued for a certain voyage and on vessels for a specified time.

315. *Adjustment of Losses.* In Marine Insurance the company pays in case of loss, such proportion of the loss as the amount of the policy bears to the value of the property. Thus if the property is insured at $\frac{1}{2}$ its value the company pays $\frac{1}{2}$ of the loss. This is upon the principle of the "average clause."

Merchants are usually provided with open policy books, which are used under the terms of an open policy and in which they enter each shipment as soon as the invoice is received. At the end of the month these books are collected by the company or its agent, the entries transferred to their books and a bill rendered the merchant for the premium.

Computations in Marine Insurance are based upon the principles of Percentage the same as in Fire Insurance.

1. A ship is insured for $85000 at $2\frac{1}{4}\%$. What is the premium?

2. A ship is insured for $35000 at $1\frac{1}{2}\%$ and her cargo is insured at $55000 at $2\frac{1}{2}\%$. What is the total premium?

3. A cargo of goods was insured for $10200, at $\frac{7}{8}\%$. What was the premium?

4. A shipment of merchandise from New York to Chicago worth $20000 is insured for $15000 at $\frac{3}{4}\%$. It is damaged to the amount of $4200. What is the company's net loss?

5. What amount must be paid for insuring a cargo of merchandise for $2500 at $1.15 and another cargo of $3700 at $1.20, less 15% discount on both premiums?

6. A vessel worth $37500 was insured for $10000 in one company at $\frac{3}{4}\%$ premium, and for $17500 in another at $\frac{7}{8}\%$ premium. She was afterwards damaged by a storm to the extent of $3000. Find the owner's loss including premium paid.

7. A New York merchant sent goods worth $1186 by water to Chicago. He insured them for $800 at $1\frac{3}{4}\%$. They are damaged to the extent of $235. What amount does the owner lose including premium paid?

8. A vessel and cargo worth $48640 were insured in the following companies, as follows: $4500 in the Paoli; $5200 in the

Leipsic ; $8600 in the West Baden ; $3350 in the Custer ; $6750 in the Litchfield. The vessel and cargo sustained a loss of $17936. What amount was paid by each company?

LIFE INSURANCE

316. Life Insurance secures a certain sum of money to be paid to a person's heirs in case of his death, or to himself, should he survive a certain number of years.

317. The *Policy* is the written contract between the parties, and sets forth the conditions of the agreement.

318. The *Ordinary Life Policy* requires payments of premium during life, and the policy is payable only upon the death of the insured.

319. The *Limited Payment Life Policy* requires premium to be paid for only a specified number of years, as five years or ten years, policy payable at death.

320. The *Endowment Policy* is payable at the end of a specified number of years or before if insured should die.

321. The *Annuity Policy* secures by a single payment of premium, the payment to the insured of a certain sum annually during his lifetime.

322. The *Beneficiary* is the person to whom the policy is made payable.

323. The *Insured* is the person whose life forms the subject matter of the policy.

A person may insure his own life or that of any person in whom he has a pecuniary interest, or upon whom he depends for support, as that of a near relative, or debtor to the amount of the debt existing. But a person cannot insure the life of a stranger or one in whom no pecuniary interest exists.

324. The *Surrender Value* of a policy is the amount of cash which the company will pay the holder at any time upon the surrender of the policy.

325. The *Expectation of Life* is the number of years that a person of a given age will probably live, based upon the records of mortality.

TABLE OF RATES.

Annual Premium for an Insurance of $1,000.

Age	Annual Premium	10 Annual Payments	15 Annual Payments	20 Annual Payments	10-Year Endowment	15-Year Endowment	20-Year Endowment	25-Year Endowment	30-Year Endowment
	LIFE POLICIES				ENDOWMENT POLICIES				
25	$20 50	$43 50	$33 10	$28 10	$105 90	$67 40	$48 70	$38 00	$31 40
26	21 00	44 30	33 80	28 60	106 00	67 50	48 90	38 20	31¹ 60
27	21 50	45 20	34 40	29 20	106 10	67 60	49 00	38 40	31 80
28	22 10	46 10	35 10	29 80	106 30	67 80	49 20	38 60	32 00
29	22 70	47 00	35 90	30 50	106 40	68 00	49 40	38 80	32 30
30	23 30	48 00	36 60	31 10	106 60	68 20	49 60	39 10	32 60
31	24 00	49 10	37 40	31 80	106 80	68 30	49 80	39 30	32 90
32	24 70	50 10	38 30	32 60	107 00	68 60	50 10	39 60	33 20
33	25 50	51 20	39 10	33 30	107 20	68 80	50 30	39 90	33 60
34	26 30	52 40	40 00	34 10	107 40	69 00	50 60	40 30	34 00
35	27 10	53 60	41 00	35 00	107 60	69 30	50 90	40 60	34 50
36	28 00	54 80	42 00	35 80	107 80	69 60	51 30	41 10	35 00
37	29 00	56 20	43 00	36 80	108 10	69 90	51 70	41 50	35 60
38	30 00	57 50	44 10	37 70	108 40	70 20	52 10	42 00	36 20
39	31 10	59 00	45 30	38 80	108 70	70 60	52 50	42 60	36 80
40	32 20	60 40	46 50	39 80	109 10	71 00	53 00	43 20	37 60
41	33 40	62 00	47 70	41 00	109 40	71 50	53 60	43 90	38 40
42	34 70	63 60	49 00	42 20	109 80	72 00	54 20	44 60	39 30
43	36 10	65 30	50 40	43 50	110 30	72 50	54 80	45 40	40 30
44	37 50	67 10	51 90	44 80	110 80	73 10	55 60	46 30	41 30
45	39 10	69 00	53 40	46 20	111 30	73 80	56 40	47 30	42 50
46	40 70	70 90	55 10	47 80	112 00	74 60	57 30	48 40	43 80
47	42 50	72 90	56 80	49 40	112 60	75 40	58 30	49 60	45 20
48	44 40	75 10	58 60	51 10	113 40	76 30	59 40	51 00	46 80
49	46 40	77 30	60 50	52 90	114 20	77 30	60 70	52 40	48 50
50	48 50	79 60	62 50	54 80	115 10	78 40	62 00	54 00	50 30

To find the annual premium which must be paid on a policy of $1000, look in the left hand column under *Age* and find the age of the insured, then opposite this look in the column descriptive of the policy and the amount will be the premium on $1,000, which multiplied by the thousands and decimals of thousands of dollars in the policy will give the premium required.

1. A man at the age of 40 desires to take out an ordinary life policy for $5000. What is the premium?

2. What is the premium on a policy for $4250, the insured being 33 years of age, by the 15 payment life plan?

3. What will be the annual premium for $2500 on a person's life at the age of 26, for 15 years, under the endowment plan?

4. A. B. Smith, 35 years of age, desires to take out an endowment policy payable in 25 years for $1500. What will it cost him annually?

5. A teacher at the age of 32 years had his life insured for $3000 by the ordinary life plan and died after making 13 payments. How much did his family receive more than he had paid the company?

6. A person aged 29 years takes out an endowment policy for $8000 payable in 20 years. He lived past the endowment period. What did he gain, having paid his premium regularly, making no allowance for risk or interest on payments?

7. A gentleman in Chicago, 32 years of age, wishing to provide for his family in case of his death, obtains a life policy for ten years for $3000. What amount of annual premium must he pay?

8. If I take an endowment policy of $3000 at the age of 28, payable to myself in 20 years, and the dividends increase the policy $912.25, how much more will I receive from the company than I have paid?

9. A gentleman, 45 years of age, gets his life insured for $5000, by the 20 year endowment plan, and dies at the age of 50 years. How much more has his insurance cost him than it would have cost by the ordinary life plan?

10. John Davidson, age 32, takes out a 25 year endowment policy for $5000. At 37 years of age he takes out a 10 year endowment for $5000. At 42 years he takes out a 15 year life policy for $5000. What are his total annual premiums after taking out his last policy?

11. A man aged 38 years secured a life policy for $8000. After making 7 annual payments he died. How much more than the amount of premium paid was received by the heirs of the person insured?

12. Amos Duncan, aged 25 years, takes out a 20 year endowment for $2500. Assuming that he will live to receive the policy how much more will he receive than he pays the company?

REVIEW PROBLEMS IN PERCENTAGE

326. *1*. What % is gained by selling ¾ of a barrel of flour for ⅝ of what the barrel cost?

2. If B loses 25% by selling his horse for $80, for how much must he sell it to gain 40%?

3. I lost $62.40 by selling 60 bbls. of flour at 24% less than cost. What was the cost per bbl.?

4. A has $1600. 75% of his money is equal to 62½% of B's money. How much have both together?

5. What is the cost of an article on which 25% is gained, after deducting 40% from the marked price, which is $10?

6. B sold his horse for $105, which was ⅚ of its cost. What % would he have gained by selling it at $109.80?

7. By selling shoes at $2.30 per pair, 8% is lost. At what price per pair must they be sold to gain 12%?

8. What % does a merchant gain by selling hats at $1.40, that were bought at $18 per dozen less 20 and 12½%?

9. A clothier reduced the price of an overcoat 90 cents, and thereby reduced his profit from 15% to 10½%. How much did it cost him?

10. Lyman paid 30% of his debt, and then found that $208 would pay 65% of the remainder. What was the amount of the debt?

11. I bought goods at ⅞ of their value and sold same at 18% more than their value, and received $3776. What did I pay?

12. From the key "Have it snow," mark goods that cost $1.52, that I may gain 25% and allow 5% from the marked price.

13. What is my rate of annual income on $1905 invested in real estate which rents for $15 per month, allowing $27.60 taxes and repairs?

14. What must be the marked price of hats that cost $2.10, that 10% may be deducted from the price, and yet a profit of 20% be made?

15. What % is gained by buying goods at a discount of 20 and 25%, and selling same at a discount of 10 and 5% ?

16. A merchant sold goods at 5% less than marked price and yet made a profit of 25%. The marked price was what % advance on cost?

17. I sold wheat at a profit of 15% ; invested the amount received in wheat again, and sold it at a profit of 18%, receiving $1709.82. How much did each lot cost me?

18. An agent sold real estate on his own account for $2780, and gained 15%. For how much should he have sold it to gain 25% ?

19. A merchant whose average profits were 12%, sold his business and loaned his money at 7½%. His annual income is reduced $427.50. Find his investment.

20. A clothing merchant paid $4.80 for a coat and marked it so that he could allow 25 and 20% discount and yet gain 30%. What was the marked price ?

21. A wholesale merchant sells goods at retail at 40% above cost and at wholesale at 15% less than retail price. What is his gain % on goods sold at wholesale ?

22. I received $5.80 less for goods sold at 12% loss, than I would have received had I sold at 17% profit. How much would be received for the goods at 30% profit ?

23. An agent sold corn at 4% commission and invested the proceeds in coffee at 5% commission ; his total commission was $312. Find the selling price of the corn and the cost of the coffee.

24. My room is 30 feet wide, and its length is 40% longer than the width. I carpet it with carpet ⅘ of a yard wide. What is the cost at 60c a yd., laid lengthwise? Laid crosswise?

25. Wilson sold a piano to Davis at a gain of 25%. Davis sold the piano for $350, which was 12½% less than the sum he paid. How much did the piano cost Wilson?

26. I sold 36% of a purchase at 15% profit, 75% of the remainder at 12% profit, and what then remained at 10% profit ; and gained $25.52. What was the amount of the purchase?

27. An agent sold a quantity of sugar at 5% commission and

invested the proceeds in corn, commission 3% for buying, at 47½ cents per bushel. Find the selling price of the sugar if he bought 5000 bushels of corn.

28. An agent sold 200 bbls. of apples at $2 per bbl. and charged 4% commission. He invested the proceeds after deducting 6⅔% for buying, in wheat at 90 cents per bu. How many bushels did he buy?

29. A merchant sold ¼ of his stock at 12% gain; ⅓ of it at 15% gain; ⅖ of it at 20% gain; the remainder which cost $295 at 25%. What was his whole gain and rate of gain?

30. A merchant bought 40 gallons of molasses at 60 cents per gallon, and lost 15% by leakage. At what price per gallon must he sell the remainder to gain 13⅓% on the total cost?

31. A wholesale merchant sold goods to Davis at 40% profit. Davis failed and was able to pay but 75% of his account. Did the merchant gain or lose and how much on a bill of $1800?

32. The price of goods was marked down 10% or to $22.50. The dealer in order to make a sale allowed another discount of 12% and then sold at a gain of 23¾%. At what % above cost were the goods marked?

33. A merchant bought 6 dozen pairs of gloves at $12.90 per dozen. He sold 2 dozen at $1.40 per pair; 1½ dozen at $1.60 per pair; and 2½ dozen at $1.20 per pair. What was his gain % on the whole lot?

34. Williams gained 20% on his investment the first year, and 25% the second year. He lost 10% the third year, and gained 12% the fourth year. His capital was then $5292. How much did he invest?

35. My agent sold a lot of grain for me at 2% commission, and invested the proceeds in dry goods at 2% for buying. His whole commission was $200. Find the cost of the dry goods and the selling price of the grain.

36. A bought two houses for $1400; 15% of the cost of the first was equal to 20% of the cost of the second. He sold the first at 13% profit and the second at 7⅝% loss. How much did he gain by the transaction?

INTEREST

327. *Interest* is the compensation allowed for the use of money.

328. The *Principal* is the money for the use of which interest is paid.

329. The *Amount* is the sum of principal and interest.

330. The *Time* is the period during which the principal bears interest.

331. The *Rate of Interest* is the rate per cent. paid for one year.

332. *Simple Interest* is the interest on the principal only.

333. *Legal Interest* is the interest or the rate fixed by law if no rate is specified in the contract.

334. *Usury* is the interest at a higher rate than allowed by law.

335. *Common Interest* is the simple interest in which 360 days are considered a year; 30 days a month; a month $\frac{1}{12}$ of a year.

This is used in finding the interest on notes and debts that bear interest for long periods of time—generally when the time is more than a year.

336. *Banker's Interest* is the simple interest in which the exact number of days of each month are reckoned, and called 360ths of a year.

This is used by banks, and by business men in finding the interest on short time notes and debts.

337. *Exact Interest* is the simple interest in which the exact number of days of each month are reckoned, and called 365ths of a year.

This is used by the U. S. Government; also in finding the interest on foreign money.

Exact interest for any time expressed in days may be obtained by subtracting $\frac{1}{73}$ from the amount of common interest. Or common

interest may be obtained from exact interest by adding thereto $\frac{1}{72}$ of the exact interest.

338. Interest is allowed on all notes, debts and contracts when it is agreed upon by the parties; on all notes, debts and contracts after they become due. When interest is allowed, though no rate of interest is expressed, the legal rate of the State is understood.

The following table shows the rates of interest and penalties for usury in the several states and territories compiled from the latest official sources. The first column shows the legal rate of interest when no rate is specified; the second column shows the maximum rate allowed by law.

STATES AND TERRITORIES.	LEGAL RATE.	HIGHEST RATE ALLOWED.	PENALTY FOR USURY.
Alabama	8 %	8 %	Forfeiture of all interest.
Alaska	8 %	12 %	
Arizona	6 %	any %	None.
Arkansas	6 %	10 %	Forfeiture of principal and interest.
California	7 %	any %	None.
Colorado	8 %	any %	None.
Connecticut	6 %	6 %	None.
Delaware	6 %	6 %	Forfeiture of double amount of loan.
Dist. of Columbia	6 %	10 %	Forfeiture of all interest.
Florida	8 %	10 %	Forfeiture of all interest.
Georgia	7 %	8 %	Forfeiture of all interest.
Hawaii	6 %	12 %	
Idaho	7 %	12 %	Forfeiture of three times the excess of interest over 12 %.
Illinois	5 %	7 %	Forfeiture of all interest.
Indian Territory	6 %	8 %	
Indiana	6 %	8 %	Forfeiture of excess of interest over 6 %.
Iowa	6 %	8 %	Forfeiture of all interest and costs.
Kansas	6 %	10 %	Forf. of double the excess of int. over 10 %.
Kentucky	6 %	6 %	Forfeiture of excess of interest.
Louisiana	5 %	8 %	Forfeiture of all interest.
Maine	6 %	any %	None.
Maryland	6 %	6 %	Forfeiture of excess of interest.
Massachusetts	6 %	any %	None.
Michigan	5 %	7 %	Forfeiture of all interest.
Minnesota	6 %	10 %	Forfeiture of contract.
Mississippi	6 %	10 %	Forfeiture of interest.
Missouri	6 %	8 %	Forfeiture of all interest.
Montana	8 %	any %	None.
Nebraska	7 %	10 %	Forfeiture of all interests and costs.
Nevada	7 %	any %	None.
New Hampshire	6 %	6 %	Forfeiture of three times the excess of interest.

STATES AND TERRITORIES.	LEGAL RATE.	HIGHEST RATE ALLOWED.	PENALTY FOR USURY.
New Jersey	6 %	6 %	Forfeiture of all interest and costs.
New Mexico	6 %	12 %	None.
New York	6 %	6 %	Forfeiture of principal and interest.
North Carolina	6 %	6 %	Forfeiture of double the amount of interest.
North Dakota	7 %	12 %	Forfeiture of all interest.
Ohio	6 %	8 %	Forfeiture of excess of interest over 8 %.
Oklahoma	7 %	12 %	
Oregon	6 %	10 %	Forfeiture of interest, principal and costs.
Pennsylvania	6 %	6 %	Forfeiture of excess of interest.
Philippine Islands	6 %	any %	
Porto Rico	12 %	12 %	
Rhode Island	6 %	any %	None.
South Carolina	7 %	8 %	Forfeiture of all interest.
South Dakota	7 %	12 %	Forfeiture of all interest.
Tennessee	6 %	6 %	Forfeiture of excess of interest.
Texas	6 %	10 %	Forfeiture of all interest.
Utah	8 %	any %	None.
Vermont	6 %	6 %	Forfeiture of excess of interest.
Virginia	6 %	6 %	Forfeiture of excess of interest over 8 %.
Washington	10 %	12 %	Forfeiture of double illegal interest.
West Virginia	6 %	6 %	Forfeiture of excess of interest.
Wisconsin	6 %	10 %	Forfeiture of all the interest.
Wyoming	8 %	12 %	None.

Interest differs from other applications of Percentage in having the element of *time* introduced.

In computations in Interest five quantities are considered, viz.: *Principal, Rate, Time, Interest* and *Amount*.

In the following problems, interest will mean common interest unless otherwise stated.

339. *To find the interest for any number of years and months.*

ORAL PROBLEMS

1. What is the interest on $150 for 1 year at 3%? at 4%? at 5%? at 6%? at $4\frac{1}{2}$%?

2. What is the interest for 1 year at 6% on the following amounts: $250, $300, $40, $96, $2000, $800, and $640.

3. Find the interest on $250 for 2 years at 3%, 4%, 5%, 6%.

4. Find the interest on $400 for 1 year 6 months at 3%, 4%, $4\frac{1}{2}$%, 5%, 6%, $7\frac{1}{2}$%.

5. What is the interest on $600 at 4% for 1 yr.? 2 yr.? 1 yr. 6

mo.? 1 yr. 3 mo.? 1 yr. 4 mo.? 1 yr. 8 mo.? 1 yr. 9 mo.? 2 yr. 6 mo.? 2 yr. 2 mo.? 2 yr. 8 mo.? 3 yr.? 3 yr. 9 mo.?

1. What is the interest on $840 for 1 year 9 months at 6%?

SOLUTION

1. 1 yr. 9 mo. = $1\frac{3}{4}$ yr.
2. $1\frac{3}{4} \times 6\% = 10\frac{1}{2}\%$.
3. $100\% = \$840$.
4. $1\% = \$8.40$.
5. $10\frac{1}{2}\% = \$88.20$.

Or,

$$\begin{array}{r} \$840 \\ .06 \\ \hline \$50.40 \end{array} = \text{interest for 1 year.}$$

$$\begin{array}{r} 1\frac{3}{4} \\ \hline 37.80 \\ 50.40 \\ \hline \end{array}$$

$88.20 = interest for $1\frac{3}{4}$ years.

EXPLANATION.—Since 1 yr. 9 mo. = $1\frac{3}{4}$ yr. and the rate for one year is 6%, for $1\frac{3}{4}$ yr. = $1\frac{3}{4}$ × 6% = $10\frac{1}{2}\%$. Since 100% equals $840, 1% equals $8.40 and $10\frac{1}{2}\%$ = $10\frac{1}{2}$ times $8.40 or $88.20. Or by the second solution, the principal multiplied by the rate equals $50.40 for one year and for $1\frac{3}{4}$ yrs. the interest will be $1\frac{3}{4}$ times $50.40 or $88.20.

From this solution and explanation we have the following:

To Find the Interest for One or More Years

a. Let 100% equal the principal.

b. Find the value of 1%.

c. Find the value of the given rate and this will be the interest for one year. Multiply this by the number of years and fractions of a year.

Or, Multiply the principal by the rate expressed decimally, and the result will be the interest for one year. Multiply this by the number of years and fractions of a year.

NOTE.—To find the amount add the interest to the principal.

Find the interest on:

2. $265 for 1 year at 8%.
3. $425.30 for 1 year at 5%.
4. $240 for 3 years at 6%.
5. $96 for 4 years at 5%.
6. $114 for 2 years at 7%.
7. $215 for 5 years at 8%.
8. $120 for 1 yr. 6 mo. at 12%.
9. $320 for 2 yr. 6 mo. at 5%.
10. $160 for 1 yr. 9 mo. at 6%.

11. $248.65 for 4 years at 7½%.

12. $45 for 6½ years at 7%.

13. $862.50 for 10 years at 8⅓%.

14. $1280 for 5 yr. 4 mo. at 6%.

15. Find the amount of $215 at 6% for 2 yr. 6 mo.

NOTE.—To find the amount add the interest to the principal.

16. Find the amount of $384.60 at 8% for 4 yr. 3 mo.

17. Find the amount of $275 at 5% for 2 yr. 8 mo.

18. Find the amount of $325.60 at 6% for 2 yr. 9 mo.

19. A merchant borrowed $450 for 2 yr. 6 mo. at 6%. What amount must he pay at the end of that time?

20. A loaned $1268 at 8% interest on May 15, 1903. What amount will be due August 15, 1905?

21. I borrowed $425.60 on July 12, 1902, at 7% interest. What amount will be due November 12, 1906?

22. On February 7, 1903, Amos Brown gave his note for $580 bearing 8% interest. He paid the note October 7, 1905. What amount did he pay?

23. A loaned B $1850 in Illinois on June 16, 1903. What amount should B pay to A in settlement February 16, 1905, no rate being specified?

24. A merchant in New York gave his note on September 10, 1903, in payment for 400 yds. of broadcloth at $1.50 per yard. What amount should he pay in settlement June 10, 1905, no rate being specified?

25. A farmer sold his farm November 1, 1903, for $4500 cash, and loaned the amount at 8% until March 1, 1905. What did the proceeds of the sale of the farm amount to then?

26. Andrew Duncan loaned $360 in Michigan on June 20, 1902, at 9%. What amount can he collect legally of this debt on October 20, 1905?

340. *To find the interest on any principal for months and days.*

1. Find the interest on $240 at 6% for 4 mo. 12 days.

SOLUTION

1. 100% = $240.

2.   1% = $2.40.

3.   6% = $14.40 = interest for 1 year.

4. $14.40 ÷ 12 = $1.20 = interest for 1 mo.

5. $1.20 × 4 = $4.80 = interest for 4 mo.

6. $1.20 ÷ 30 = $.04 = interest for 1 day.

7. $.04 × 12 = $.48 = interest for 12 days.

8. $4.80 + $.48 = $5.28 = interest for 4 mo. 12 days.

From this solution and explanation we have the rule:

To Find the Interest for Months and Days

a. Find the interest for one year.

b. Divide the interest for one year by 12 and multiply this by the given number of months.

c. Divide the interest for 1 mo. by 30 and multiply by the given number of days.

d. Add the several results together.

NOTE.—Where the months are aliquot parts of 12, or the days aliquot parts of 30, solve by the rule for aliquot parts. Thus 3 mo. = ¼ of a year; 10 days = ⅓ of a mo.

2. What is the interest on $72 at 6% for 3 months?

3. What is the interest on $48.50 at 8% for 4 months?

4. What is the interest on $150 at 6% for 6 months?

5. What is the interest on $240 at 8% for 7 months?

6. What is the interest on $275.30 at 6% for 9 months?

7. What is the interest on $340 at 6% for 10 days?

8. What is the interest on $420 at 7% for 15 days?

9. What is the interest on $500 at 8% for 12 days?

10. What is the interest on $480 at 6% for 24 days?

11. What is the interest on $180 at 8% for 28 days?

12. What is the interest on $960 at 6% for 6 mo. 15 days?

13. What is the interest on $100.80 at 8% for 5 mo. 18 days?

14. What is the interest on $228 at 6% for 9 mo. 20 days?

15. What is the interest on $375 at 8% for 3 mo. 11 days?

16. What is the interest on $268 at 5% for 8 mo. 9 days?

17. What is the interest on $1280 at 4½% for 7 mo. 16 days?

18. What is the interest on $375 at 9% for 11 mo. 14 days?

19. What is the interest on $840 at 6% for 5 mo. 18 days?

20. What is the interest on $1365 at 8% for 10 mo. 10 days?

21. What is the interest on $280 for 2 yr. 2 mo. 2 da. at 6%?

22. What is the interest on $1620 for 3 yr. 8 mo. 6 da. at 7%?

23. Find the interest on $440 for 3 yrs. 6 mo. at 7%.

24. Find the interest on $400 for 1 yr. 2 mo. 12 days at 9%.

25. Find the interest on $620 for 1 yr. 6 mo. 24 days at 4%.

26. Find the interest on $218 for 2 yrs. 9 mo. 18 days at 8%.

27. Find the interest on $1250 for 3 yrs. 10 mo. 6 days at 10%.

28. Find the interest on $960 for 18 days at 6%.

29. Find the interest on $260 for 25 days at 8%.

30. Find the interest on $1080 for 20 days at 10%.

31. Find the interest on $480 for 15 days at 9%.

32. Find the interest on $1297.60 for 8 mo. 10 days at 9%.

33. Find the interest on $1264.80 for 11 mo. 20 days at 6%.

34. Find the interest on $76.50 for 3 mo. 15 days at 8%.

35. How much interest will $750 produce at 11% from May 12, 1900, to May 12, 1905?

36. I borrowed $225 on October 30, 1902, at 7% interest. What amount of interest was due October 30, 1905?

37. On January 17, 1904, B loaned $248 at 6% interest. Find the amount of interest due on May 17, 1905.

38. $190 was borrowed August 21, 1903, and the interest on it was paid May 21, 1905, at 10%. Find the amount of interest.

39. Smith borrowed $336 on July 5, 1902, at 5% interest. He paid the interest on same February 1, 1905. What was the amount of interest?

40. On June 6, 1903 Lyman gave his note for $240, bearing 10% interest. He paid the note May 21, 1905. Find the amount of interest.

41. I accepted a note dated August 7, 1903, in payment of a lot sold for $744. The interest at 9% was paid October 21, 1905. What amount of interest did I receive?

42. A received a note dated April 3, 1902, for $25, bearing 4% interest. The maker of the note paid the interest in full on November 9, 1905. Find the amount of interest paid.

43. A merchant sold goods amounting to $1140 on January 6,

1905. He received in payment a note of same date, bearing 12% interest. What amount of interest is due on March 26, 1905?

44. Brown gave his note to B, for borrowed money, on March 22, 1905. He agreed to pay 7% interest if the note was paid in less than 30 days, and 6% if it was not paid in that time. He paid the note April 20. Find the amount of interest, the principal being $2450.

NOTE.—Time by compound subtraction.

SIXTY DAYS METHOD

341. *To find the interest at 6% when the time is in days.*

At 6%, the interest is 6 cts. on $1 for 1 year or 12 mo. Therefore the interest will be 1c for 2 mo. or 60 days.

ORAL PROBLEMS

The interest on $75 for 1 yr. at 1% is $.75.

The interest on $75 for 6 mo. at 2% is $.75.

The interest on $75 for 4 mo. at 3% is $.75.

The interest on $75 for 3 mo. at 4% is $.75.

The interest on $75 for 2 mo. (60 da.) at 6% is $.75.

1. What is the interest for one year at one per cent. on : $600, $750, $450, $250, $375, $48, $9, $28, $24.36?

2. What is the interest for 2 mo. at 6% on : $200, $320, $450, $24, $36, $84, $920, $7?

3. What is the interest on $720 for 60 days at 6%? for 30 days? for 20 days? 15 da.? 12 da.? 6 da.? 3 da.?

4. What is the interest on $6000 for 60 days at 6%? 59 da.? 125 da.? 62 da.; 84 da.?

WRITTEN PROBLEMS

1. Find the interest on $350 at 6% for 90 days.

SOLUTION

$3.50 = interest for 60 days.

$1.75 = interest for 30 days.

$5.25 = interest for 90 days.

Therefore we have the following :

Rule for the Sixty Days Method

a. Point off two decimal places in the principal and the result will be the interest at 6% for 60 days.

b. To obtain the interest for a longer or shorter time than 60 days add to or subtract from the interest for 60 days.

c. To obtain the interest for a greater or less rate than 6%, add to, or subtract from, the result at 6%.

Find the interest on :

2. $280 for 60 days at 6%.   12. $520 for 72 da. at 5%.
3. $530 for 30 da. at 6%.   13. $384.25 for 36 da. at 4½%.
4. $480 for 90 days at 6%.   14. $250 for 40 da. at 7½%.
5. $780 for 63 da. at 6%.   15. $1825 for 6 da. at 8%.
6. $416 for 33 days at 7%.   16. $127.30 for 8 da. at 3%.
7. $865.20 for 93 da. at 5%.   17. $416.25 for 5 da. at 5½%.
8. $265.50 for 120 da. at 8%   18. $580 for 33 da. at 7%.
9. $840 for 75 da. at 4%.   19. $184.60 for 36 da. at 5%.
10. $1740 for 45 da. at 9%.   20. $465.30 for 27 da. at 8%.
11. $1250 for 48 da. at 7%.

SIX PER CENT. METHOD

342. *To find the interest at 6% when the time is in years, months or days.*

The interest on $1 for 1 year   = .06.
The interest on $1 for 2 months   = .01.
The interest on $1 for 1 month   = .005.
The interest on $1 for 6 days   = .001.
The interest on $1 for 1 day   = .000⅙.

1. What is the interest on $120 for 2 yr. 4 mo. 24 da. at 6% ?

SOLUTION

1. 2 $\times$ $.06 = $.12 interest for 2 years.
2. 4 $\times$ $.005 = .02 interest for 4 months.
3. 24 $\times$ $.000⅙ = .004 interest for 24 days.
4. Int. on $1   = $\overline{\$.144}$
5. 120 $\times$ $.144 = $17.28.

From the foregoing solution and explanation we have the

Rule for Six Per Cent. Method

a. Take as many cents as six times the years, one cent for every two months, one mill for every six days and one-sixth of a mill for every additional day.

b. Add together these results and we have the interest upon $1 for the time and rate, which multiply by the given principal.

c. To obtain the interest for a greater or less rate than 6% add to, or subtract from, the result at 6%.

2. Find the interest on $360 for 1 yr. 8 mo. 18 da. at 6%.

3. Find the interest on $500 for 3 yr. 10 mo. 15 da. at 6%.

4. Find the interest on $1360 for 4 yr. 7 mo. 24 da. at 6%.

5. Find the interest on $3200 for 2 yr. 5 mo. 15 da. at 7%.

6. Find the interest on $1270 for 10 mo. 12 da. at 8%.

7. Find the interest on $768 for 5 yr. 4 mo. 7 da. at 9%.

8. Find the interest on $940 for 11 mo. 27 da. at 5%.

9. Find the interest on $660 for 9 mo. 9 da. at 4%.

10. Find the interest on $475 for 5 mo. 3 da. at $4\frac{1}{2}$%.

11. Find the amount of $540 for 1 yr. 10 mo. 12 da. at 8%.

12. Find the amount of $2400 for 24 da. at $7\frac{1}{2}$%.

13. Find the amount of $1287.40 for 1 mo. 11 da. at 7%.

14. Find the amount of $847.80 for 3 mo. 26 da. at $6\frac{1}{2}$%.

15. Find the amount of $126.10 for 2 mo. 16 da. at 8%.

16. Find the amount of a note for $218.30 for 2 mo. 20 da. at $5\frac{1}{2}$%.

17. Find the amount of a note for $1625.30 at 7% for 1 yr. 2 mo. 18 da.

18. Find the amount of $735.40 at 10% interest for 3 mo. 25 da.

19. Find the amount of a note for $1420 at $4\frac{1}{2}$% for 3 yr. 5 mo. 15 da.

20. Find the amount of a note for $234.60 at $8\frac{1}{2}$% for 5 yr. 7 mo. 4 da.

21. Find the amount of a note at 7% for $185.60 dated Oct. 10, 1903, and paid June 8, 1905.

22. S. B. Davis borrowed $750 on Aug. 10, 1903, at 5% interest. He paid both principal and interest June 18, 1905. What amount did he pay?

CANCELLATION METHOD

343. *To find the interest when the operation is shortened by the use of cancellation.*

1. Find the interest on $350 for 9 mo. at 8%.

SOLUTION

$$\$350 \times 3 \times .02 = \$21.00 \text{ int.}$$

We therefore have the following:

Rule for Cancellation Method

a. Upon the right of a perpendicular line write the principal, time in months or days and the rate.

b. If the time is in months place 12 upon the left of the line, or if in days place 360 upon the left of the line (unless the accurate interest is required, in which case place 365).

c. Cancel and multiply the remaining factors together for the required result.

NOTE.—The time must be all in months or days, and not in both. Common interest is understood unless otherwise stated.

2. Find the interest on $480 at 6% for 8 mo.

3. Find the interest on $720 at 5% for 9 mo. 10 da.

4. Find the interest on $1250 at 6% for 2 yr. 6 mo. 6 da.

5. Find the interest on $160 at 6% for 1 yr. 9 mo. 18 da.

6. Find the interest on $320 at 5% for 2 yr. 4 mo. 20 da.

7. Find the interest on $440 at 7% for 3 yr. 1 mo. 15 da.

8. Find the interest on $400 at 9% for 1 yr. 2 mo. 28 da.

9. Find the interest on $750 at 8% for 11 mo. 16 da.

10. Find the interest on $1264.80 at 6% for 42 da.

11. Find the interest on $225 at 7% for 108 da.

12. Find the interest on $1140 at 7% for 11 mo. 20 da.

13. Find the amount of a note for $1600 drawing 8% interest for 25 da.

14. Find the amount of a note for $1080 at 5% for 3 mo. 15 da.

15. A note for $2500 dated April 3, 1905, draws 7% interest until Nov. 19, 1905. What will it then amount to?

COMMON, BANKER'S AND EXACT INTEREST COMPARED

344. *1.* Find the common, banker's and exact interest on a note of $600 at 8%, dated January 15, 1905, and due August 24, 1905.

COMMON INTEREST—SIX PER CENT. METHOD

$$1905 — 8 — 24.$$
$$1905 — 1 — 15.$$
$$\overline{\hspace{1cm} 7 — \ 9.}$$
7 mo. 9 da. = 219 da.

$6.00 = int. for 60 da.
$12.00 = int. for 120 da.
$3.00 = int. for 30 da.
$.60 = int. for 6 da.
$.30 = int. for 3 da.

$21.90 = int. at 6%.
$7.30 = int. at 2%.
$29.20 = int. at 8%.

Note.—In common interest we reckon 30 days as a month and find the time by compound subtraction. In Banker's and Exact interest we find the exact number of days.

BANKER'S INTEREST—SIX PER CENT. METHOD

16 days in January.
28 days in February.
31 days in March.
30 days in April.
31 days in May.
30 days in June.
31 days in July.
24 days in August.

221 days.

$6.00 = int. for 60 da.
$12.00 = int. for 120 da.
$3.00 = int. for 30 da.
$1.00 = int. for 10 da.
$.10 = int. for 1 da.

$22.10 = int. at 6%.
$7.36⅔ = int. at 2%.
$29.46⅔ = int. at 8%.

EXACT INTEREST

16 days in January.
28 days in February.
31 days in March.
30 days in April.
31 days in May.
30 days in June.
31 days in July.
24 days in August.

221 days.

$221 \text{ days} = \tfrac{221}{365} \text{ yr.}$
$\$600 \times \tfrac{8}{100} \times \tfrac{221}{365} = \$29.07.$
$\$29.07 = \text{exact interest.}$

2. What is the banker's interest on $720 from May 12, 1904, to January 5, 1905, at 6%?

3. What is the exact interest on $365 from December 10, 1904, to March 15, 1905, at 6%?

4. Find the difference between common interest and banker's interest on $98.50 from April 1, to October 30, at 5%.

5. Find the difference between common interest and exact interest on $210 from July 23, to November 28, at 10%.

6. Find the difference between banker's interest and exact interest on $190 from August 9, 1904, to March 16, 1905, at 6%.

7. Find the banker's interest on a note of $288 from January 4, to September 7, at 10%.

8. What is the exact interest on a note of $109.50, dated June 7 and due December 23, bearing 5% interest?

9. What is the common interest paid on a note of $178.25, at 8%, dated March 1, 1903, and due August 1, 1905?

10. What is the difference between banker's interest and exact interest on a note of $1460 bearing 10%, dated April 6, 1904, and due March 9, 1905?

11. Which is the greater, and how much greater, common interest or banker's interest on a note of $432 from September 16, 1904, to June 2, 1905, at 7%?

12. Which is the greater, and how much greater, common interest or exact interest on a debt of $182.50, from July 30, 1904, to April 14, 1905, at 9%?

13. I borrowed $2555 at exact interest and loaned same at banker's interest. Did I gain or lose, and how much from May 5, to November 22, interest at $7\frac{1}{2}$%?

14. Would I gain or lose and how much, to borrow $32850 at 8%, at common interest and loan it at exact interest from December 28, 1904, to July 13, 1905?

15. How much is gained, money worth $6\frac{1}{2}$%, by borrowing $4800 at common interest and loaning it at banker's interest from July 23, 1904, to June 26, 1905?

16. Find the interest on 7 U. S. bonds of $1000 each from November 6 to March 28, at $4\frac{1}{2}$%

NOTE.—Exact interest is used in computing interest on U. S. securities and foreign money.

17. Find the interest on a $500 U. S. bond, bearing 4½% interest from April 1 to July 25.

18. What is the interest on £240 9s. 3d. for 90 days at 8%?

NOTE.—Reduce shilling and pence to decimal of a pound, then find the interest as in U. S. money, after which reduce the decimal of pounds back to lower denominations.

19. What is the interest on £920 7s. 6d. from February 5 to July 1, at 5%?

20. Find the interest on £1335 11s. 3d. at 4%, from March 4 to October 10.

21. Find the interest on a note of £270 12s. at 7%, from April 10 to September 3.

22. Find the interest on a note of £120 15s. at 6%, for 146 days.

23. Find the interest on £1999 8s. 9d. from July 8, 1905 to Oct. 24, 1907 at 10%.

PROBLEMS IN INTEREST

345. *To find the time, when the principal, rate and interest or amount are given.*

1. I received $9 interest on $150 loaned at 4%. For how long was the money loaned?

SOLUTION

$150
  .04
‾‾‾‾‾‾
$6.00 = interest for 1 yr.
$9 ÷ $6 = 1½ or 1 yr. 6 mo.

From this solution we have the following:

To Find the Time

a. Find the interest on the principal for one year.

b. Divide the given interest by the interest for one year and the result will be the time in years.

2. In what time will $280 produce $19 interest at 7%?

3. In what time will $160 produce $15.36 interest at 8%?

4. In what time will $225 produce $72.90 interest at 9%?

5. In what time will $618.50 produce $25.14 interest at 6%?

6. In what time will $750 produce $2.25 interest at 4%?

7. I received $33 interest on a loan of $300 at 5%. For how long was the money loaned?

8. A farmer borrowed $640 at 9% on June 1, 1904, and paid $801.28 for the note and interest at maturity. Find the maturity of the note.

9. On July 16, 1905, I paid $860.36 for a note of $785, bearing 12% interest. Find the date of the note.

10. What is the date of a note bearing 11% interest for $190 on which $52.25 interest was due May 30, 1905?

11. I borrowed $335 on February 4, 1905, and found the amount at maturity to be $452.92. When will the note mature, it bearing 8% interest?

12. On August 24, 1905, I borrowed $600 on my note at $4\frac{1}{2}$% interest and at maturity paid $621 for note and interest. Find the date of maturity, allowing banker's interest.

346. *To find the rate, when the principal or amount, interest and time are given.*

1. At what rate of interest will $500 in 1 yr. 8 mo. 24 da. produce $52?

SOLUTION

$5.00 = int. 1 yr. 1%.

  2.50 = int. 6 mo.

   .83$\frac{1}{3}$ = int. 2 mo.

   .27$\frac{7}{9}$ = int. 20 da.

   .05 = int. 4 da.

8.66\frac{2}{3}$ = int. at 1%.

$52 ÷ 8.66\frac{2}{3}$ = 6 = 6%.

From this solution and explanation we have the following:

To Find the Rate

a. Find the interest on the principal at 1% for the given time.

b. Divide the given interest by the interest at 1%, and the result will be the rate.

Note.—If the amount is given, subtract the principal from it to find the interest.

2. At what rate of interest will $720 produce $172.80 in 3 yrs.?

3. At what rate of interest will $480 produce $84 in 2 yrs. 6 mo.?

4. At what rate of interest will $320 produce $48.96 in 3 yrs. 9 mo. 27 days?

5. At what rate of interest will $1275 produce $242.25 in 1 yr. 10 mo. 24 days?

6. At what rate of interest will $85 produce $43.01 in 4 yrs. 7 mo. 6 days?

7. A paid $36 interest on a note of $240, that had been on interest for 1 yr. 8 mo. Find the rate of interest.

8. I loaned Smith $900 for 2 yrs. 8 mo. 12 days, and at the end of that time he paid me $1094.40 in full for his note and interest. What rate of interest did the note draw?

9. A merchant received from Brown $218.96 for his note of $170 that had been at interest for 3 yrs. 7 mo. 6 days. What rate of interest was charged?

10. Snyder borrowed on his note $97.50 for 1 yr. 7 mo. 18 days. He paid $6 interest at the end of the year, and at maturity found the sum due was $101.055. Find the rate of interest.

11. On January 6 I loaned $144, and on December 31 received the amount due, which was $158.20. What rate of interest did I charge?

12. B borrowed $45 on October 30, 1905, and paid the note and interest with $47.39 on June 29, 1906. Find the rate of interest he paid.

347. *To find the principal, when the interest, rate and time are given.*

1. I received $226 interest on a sum loaned for 1 yr. 4 mo. at 6%. How much was the loan?

SOLUTION

$.06 = int. on \$1 for 1 yr.

.02 = int. on \$1 for 4 mo.

$.08 = int. on \$1 for the given time
          and rate.

$226 ÷ .08 = \$2825 = the principal.

From the foregoing we have the following:

To Find the Principal

a. *Find the interest on \$1 for the given time at the given rate.*

b. *Divide the given interest by the interest on \$1, and the quotient will be the required principal.*

2. What principal will produce \$62.50 interest in 2 yrs. 6 mo. at 5%?

3. What principal will produce \$39.78 interest in 1 yr. 4 mo. 18 days at 9%?

4. What principal will produce \$63.22 interest in 3 yrs. 7 mo. 15 days at 8%?

5. What principal will produce \$11.22 interest in 9 mo. 27 days at 10%?

6. What principal will produce \$20.235 interest in 4 mo. 20 days at 12%?

7. B paid me \$154.47 interest on a note bearing 9%. What was the principal if the note was for 2 yrs. 3 mo. 3 days?

8. James Irwin received \$10.97 interest on a note bearing 7% interest. The note was dated January 6, 1905, and paid July 12, 1906. Find the principal.

9. The interest on a note bearing 6%, dated October 14, 1905, and paid August 10, 1906, was \$39.43⅓. Find the principal.

10. I paid \$420 for a stock of goods and sold same to B on his note for 2 yrs. 6 mo. at 6% interest. The interest on the note was \$71.19. At what % profit did I sell the goods?

11. William Graham borrowed money on his note at 4% for 3 yrs. 8 mo. 12 days. He invested the sum borrowed in potatoes at 25 cents per bushel. How many bushels did he buy, if the interest for the time was \$18.50?

16

348. *To find the principal when the amount, rate and time are given.*

1. What principal in 2 yrs. 1 mo. 15 days at 8% interest will amount to $421.20?

$.17 = int. on $1 for the given
        time and rate.

1.00

$1.17 = amount of $1.

$421.20 ÷ 1.17 = $360 principal.

2. What principal in 3 yrs. 9 mo. 21 days at 7% interest will amount to $303.98?

3. What principal in 5 yrs. 7 mo. 28 days at 9% interest will amount to $558.51½?

4. What principal in 11 mo. 10 days at 10% interest will amount to $1280.50?

5. What principal in 5 mo. 12 days at 5% interest will amount to $184.05?

6. I owe $780, due in 2 yrs. 6 mo. What sum will pay it now, if money is worth 8% interest?

7. A note bearing 7% interest, having run for 1 yr. 2 mo. 12 days, was paid with $596.20. Find the principal.

8. Adams paid $2592.60 for his note that had been on interest for 2 yrs. 4 mo. 24 days at 8%. What was the principal of the note?

9. What sum is required to pay a debt of $125.78, due in 3 yrs. 7 mo. 6 days, if interest is allowed at 9%?

10. West borrowed $296.01 to pay a note that had been on interest at 4% for 10 mo. 15 days. Find the sum for which the note was given.

11 I bought goods to the amount of $757.12 on 4 mo. 24 days time. I borrowed money and paid cash for the goods. How much did I borrow if 10% interest was allowed?

ANNUAL INTEREST

349. *Annual Interest* is interest payable annually or at other regular intervals of time.

350. If the *Annual Interest* is not paid when due, it draws simple interest from the time it becomes due until it is paid.

Annual interest is legalized in Michigan at the same rate as secured by the contract; in Ohio, Wisconsin, Vermont, New Hampshire, and Iowa, at 6%; and in Pennsylvania, Georgia, Illinois and Indiana, by special contract only.

When notes are made to run for a term of years secured by real estate or collaterals, it is customary to represent the principal by one or more "Principal notes" which do not read to draw interest, and then the several payments of interest are evidenced by interest notes maturing at the time each interest payment is payable. These interest notes as well as the principal notes are entitled to draw interest after maturity, like any other note.

1. What is due on a note of $300 at 6% for five years, interest payable annually, no payment having been made until the maturity of the note?

SOLUTION

$300
  .06
$\overline{\$18.00}$ = int. for 1 yr.
      5
 $\overline{\$90.00}$ int. for 5 yr.
4 yr. + 3 yr. + 2 yr. + 1 yr. = 10 yr.
Int. on $18 for 10 yr. = $10.80.
$300 + $90 + $10.80 = $400.80.

From the foregoing solution we have the following:

To Find the Annual Interest

a. Find the interest on the principal until the time of settlement.

b. Find the interest upon the first year's interest for the sum of the times which the several payments of interest have to run until maturity.

c. Add together the principal, the interest thereon, and the in-

*terest due on each year's interest. The result will be the amount
due at maturity.*

NOTE.—In case the interest is payable semi-annually or quarterly it is
computed in the same manner as annually, substituting a half or quarter
year for year.

2. Find amount due on a note of $800 for 1 yr. 8 mo. 12 days
at 8%, interest payable quarterly, no payments being made be-
fore maturity of the note.

NOTE.—At the expiration of each quarter, $16 is due. The first quarter's
interest bears interest for 1 yr. 5 mo. 12 days; the second quarter's, for 1
yr. 2 mo. 12 days, etc.

Find the amount due on the following notes, no payments hav-
ing been made before maturity of the note.

3. $350 for 3 years at 7%, interest payable annually.

4. $910 for 3 yrs. 7 mo. 15 days at 10%, interest payable an-
nually.

5. $460 for 2 years at 5%, interest payable semi-annually.

6. $590 for 1 yr. 11 mo. 12 days at 8%, interest payable semi-
annually.

Find the amount due on the following notes, no payments hav-
ing been made:

7. $1290 for 1 year at 4%, interest payable quarterly.

8. $180 for 1 yr. 9 mo. 18 days at 10%, interest payable quar-
terly.

9. What is the interest on a debt of $680 due in 3 yrs. 4 mo.
18 da. at 7% interest payable annually and no payments having
been made?

10. On August 16, 1902, A loaned $3465 at 5%, interest pay-
able quarterly. If no payments have been made, what amount
was due January 1, 1904?

11. A farmer borrowed $1250 on June 1, 1903, and gave his
note drawing 6% interest payable semi-annually. If no pay-
ments have been made, what will be the amount of the note April
13, 1905?

COMPOUND INTEREST

351. *Compound Interest* is the interest on the principal and its unpaid interest added to it at the end of each period of time for which the interest is made payable.

352. *Interest* may be compounded according to agreement, at the end of each year, half year or any other period of time.

Compound interest cannot be enforced by law in most of the states, but if the debtor is willing to pay compound interest he may do so without violating the law against usury.

1. What is the compound interest on $300 at 8% for three years, interest compounded annually?

SOLUTION

1. $300 × .08 = $24, interest first year.
2. $300 + $24 = $324, principal second year.
3. $324 × .08 = $25.92, interest second year.
4. $324 + $25.92 = $349.92, principal third year.
5. $349.92 × .08 = $27.994, interest third year.
6. $349.92 + $27.994 = $377.914, amount due.
7. $377.914 — $300 = $77.914, the compound interest.

From this solution and explanation we have the following:

To Find the Compound Interest

a. Find the amount of the principal for one year and make this the principal for the second year.

b. Find the amount of this new principal for the second year and make it the principal for the third year, etc.

c. Subtract the original principal from the last amount and the result will be the compound interest.

NOTES.—1. When the interest is payable semi-annually or quarterly, find the amount of the given principal for the first interval, and make it the principal for the second interval, proceeding in all respects as when the interest is payable yearly.

2. When the time contains years, months and days, find the amount for the even intervals upon which compute the interest for the remaining months and days, and add it to the last amount, before subtracting.

Find the compound interest of

2. $600 for 4 years at 5%, interest compounded annually.

3. $720 for 3 years at 9%, interest compounded annually.

4. $1800 for 4 yrs. 8 mo. 12 days at 10%, interest compounded annually.

5. $860 for 2 years at 8%, interest compounded semi-annually.

6. $2700 for 2 yrs. 4 mo. at 6%, interest compounded semi-annually.

7. $3350 for 3 yrs. 2 mo. 20 days at 10%, interest compounded semi-annually.

8. $180 for 1 year at 5%, interest compounded quarterly.

9. $450 for 1 yr. 1 mo. at 7%, interest compounded quarterly.

10. $920 for 1 yr. 7 mo. 24 days at 8%, interest compounded quarterly.

Where the time is long, the labor of computing compound interest may be greatly shortened by using the table.

To find the compound amount of $1 by the table look in the column at the left of the page for the years and under the given rate per cent. at the top of the page.

If the interest is compounded semi-annually, it is equivalent to double the number of years at half the rate per cent. or quarterly, four times the years at one-fourth the rate.

The amount of $1 as found by the table, multiplied by the given principal will give the compound amount of the principal.

The labor of computing compound interest may be greatly shortened by the use of the following:

Compound Interest Table

Showing the amount of $1 at compound interest at various rates per cent. for any number of years, from 1 year to 50 years, inclusive.

Years.	1 per ct.	1½ per ct.	2 per ct.	2½ per ct.	3 per ct.	3½ per ct.	4 per ct.
1	1.0100 000	1.0150 000	1.0200 0000	1.0250 0000	1.0300 0000	1.0350 0000	1.0400 0000
2	1.0201 000	1.0302 250	1.0404 0000	1.0506 2500	1.0609 0000	1.0712 2500	1.0816 0000
3	1.0303 010	1.0456 784	1.0612 0800	1.0768 9062	1.0927 2700	1.1087 1787	1.1248 6400
4	1.0406 040	1.0613 636	1.0824 3216	1.1038 1289	1.1255 0881	1.1475 2300	1.1698 5856
5	1.0510 101	1.0772 840	1.1040 8080	1.1314 0821	1.1592 7407	1.1876 8631	1.2166 5290
6	1.0615 202	1.0934 433	1.1261 6242	1.1596 9342	1.1940 5230	1.2292 5533	1.2653 1902
7	1.0721 354	1.1098 450	1.1486 8567	1.1886 8575	1.2298 7387	1.2722 7926	1.3159 3178
8	1.0828 567	1.1264 926	1.1716 5938	1.2184 0290	1.2667 7008	1.3168 0904	1.3685 6905
9	1.0936 853	1.1433 900	1.1950 9257	1.2488 6297	1.3047 7318	1.3628 9735	1.4233 1181
10	1.1046 221	1.1605 408	1.2189 9442	1.2800 8454	1.3439 1638	1.4105 9876	1.4802 4428
11	1.1156 683	1.1779 489	1.2433 7431	1.3120 8666	1.3842 3387	1.4599 6972	1.5394 5406
12	1.1268 250	1.1956 182	1.2682 4179	1.3448 8882	1.4257 6089	1.5110 6866	1.6010 3222
13	1.1380 933	1.2135 524	1.2936 0663	1.3785 1104	1.4685 3371	1.5639 5606	1.6650 7351
14	1.1494 742	1.2317 557	1.3194 7876	1.4129 7382	1.5125 8972	1.6186 9452	1.7316 7645
15	1.1609 690	1.2502 321	1.3458 6834	1.4482 9817	1.5579 6742	1.6753 4883	1.8009 4351
16	1.1725 786	1.2689 855	1.3727 8570	1.4845 0562	1.6047 0644	1.7339 8601	1.8729 8125
17	1.1843 044	1.2880 203	1.4002 4142	1.5216 1826	1.6528 4763	1.7946 7555	1.9479 0050
18	1.1961 475	1.3073 406	1.4282 4625	1.5596 5872	1.7024 3306	1.8574 8920	2.0258 1652
19	1.2081 090	1.3269 507	1.4568 1117	1.5986 5019	1.7535 0605	1.9225 0132	2.1068 4918
20	1.2201 900	1.3468 550	1.4859 4740	1.6386 1644	1.8061 1123	1.9897 8886	2.1911 2314
21	1.2323 919	1.3670 578	1.5156 6634	1.6795 8185	1.8602 9457	2.0594 3147	2.2787 6507
22	1.2447 159	1.3875 637	1.5459 7967	1.7215 7140	1.9161 0341	2.1315 1158	2.3699 1879
23	1.2571 630	1.4083 772	1.5768 9926	1.7646 1068	1.9735 8651	2.2061 1448	2.4647 1555
24	1.2697 346	1.4295 028	1.6084 3725	1.8087 2595	2.0327 9411	2.2833 2849	2.5633 0417
25	1.2824 320	1.4509 454	1.6406 0599	1.8539 4410	2.0937 7793	2.3632 4498	2.6658 3633
26	1.2952 563	1.4727 095	1.6734 1811	1.9002 9270	2.1565 9127	2.4459 5856	2.7724 6979
27	1.3082 089	1.4948 002	1.7068 8648	1.9478 0002	2.2212 8901	2.5315 6711	2.8833 6858
28	1.3212 910	1.5172 222	1.7410 2421	1.9964 9502	2.2879 2768	2.6201 7196	2.9987 0332
29	1.3345 039	1.5399 805	1.7758 4469	2.0464 0739	2.3565 6551	2.7118 7798	3.1186 5145
30	1.3478 490	1.5630 802	1.8113 6158	2.0975 6758	2.4272 6247	2.8067 9370	3.2433 9751
31	1.3613 274	1.5865 264	1.8475 8882	2.1500 0677	2.5000 8035	2.9050 3148	3.3731 3341
32	1.3749 407	1.6103 243	1.8845 4059	2.2037 5694	2.5750 8276	3.0067 0759	3.5080 5875
33	1.3886 901	1.6344 792	1.9222 3140	2.2588 5086	2.6523 3524	3.1119 4235	3.6483 8110
34	1.4025 770	1.6589 964	1.9606 7603	2.3153 2213	2.7319 0530	3.2208 6033	3.7943 1634
35	1.4166 028	1.6838 813	1.9998 8955	2.3732 0519	2.8138 6245	3.3335 9045	3.9460 8899
36	1.4307 688	1.7091 395	2.0398 8734	2.4325 3532	2.8982 7833	3.4502 6611	4.1039 3255
37	1.4450 765	1.7347 766	2.0806 8509	2.4933 4870	2.9852 2668	3.5710 2543	4.2680 8986
38	1.4595 272	1.7607 983	2.1222 9879	2.5556 8242	3.0747 8348	3.6960 1132	4.4388 1345
39	1.4741 225	1.7872 103	2.1647 4477	2.6195 7448	3.1670 2698	3.8253 7171	4.6163 6599
40	1.4888 637	1.8140 184	2.2080 3966	2.6850 6384	3.2620 3779	3.9592 5972	4.8010 2063
41	1.5037 524	1.8412 287		2.7521 9043	3.3598 9893	4.0978 3381	4.9930 6145
42	1.5187 899	1.8688 471		2.8209 9520	3.4606 9589	4.2412 5799	5.1927 8391
43	1.5339 778	1.8968 798		2.8915 2008	3.5645 1677	4.3897 0202	5.4004 9527
44	1.5493 176	1.9253 330		2.9638 0808	3.6714 5227	4.5433 4160	5.6165 1508
45	1.5648 107	1.9542 130		3.0379 0328	3.7815 9584	4.7023 5855	5.8411 7568
46	1.5804 589	1.9835 262	2.4866 1129	3.1138 5086	3.8950 4372	4.8669 4110	6.0748 2271
47	1.5962 634	2.0132 791	2.5363 4351	3.1916 9713	4.0118 9503	5.0372 8404	6.3178 1562
48	1.6122 261	2.0434 783	2.5870 7039	3.2714 8956	4.1322 5188	5.2135 8898	6.5705 2824
49	1.6283 483	2.0741 305	2.6388 1179	3.3532 7680	4.2562 1944	5.3960 6459	6.8333 4937
50	1.6446 318	2.1052 424	2.6915 8803	3.4371 0872	4.3839 0602	5.5849 2686	7.1066 8335

Compound Interest Table

Showing the amount of $1 at compound interest at various rates per cent. for any number of years, from 1 year to 50 years, inclusive.

Years.	4½ per ct.	5 per ct.	6 per ct.	7 per ct.	8 per ct.	9 per ct.	10 per ct.
1	1.0450 0000	1.0500 000	1.0600 000	1.0700 000	1.0800 000	1.0900 000	1.1000 000
2	1.0920 2500	1.1025 000	1.1236 000	1.1449 000	1.1664 000	1.1881 000	1.2100 000
3	1.1411 6612	1.1576 250	1.1910 160	1.2250 430	1.2597 120	1.2950 290	1.3310 000
4	1.1925 1860	1.2155 063	1.2624 770	1.3107 960	1.3604 890	1.4115 816	1.4641 000
5	1.2461 8194	1.2762 816	1.3382 256	1.4025 517	1.4693 281	1.5386 240	1.6105 100
6	1.3022 6012	1.3400 956	1.4185 191	1.5007 304	1.5668 743	1.6771 001	1.7715 610
7	1.3608 6183	1.4071 004	1.5036 303	1.6057 815	1.7138 243	1.8280 391	1.9487 171
8	1.4221 0061	1.4774 554	1.5938 481	1.7181 862	1.8509 302	1.9925 626	2.1435 888
9	1.4860 9514	1.5513 282	1.6894 790	1.8384 592	1.9990 046	2.1718 933	2.3579 477
10	1.5529 6942	1.6288 946	1.7908 477	1.9671 514	2.1589 250	2.3673 637	2.5937 425
11	1.6228 5305	1.7103 394	1.8982 986	2.1048 520	2.3316 390	2.5804 264	2.8531 167
12	1.6958 8143	1.7958 563	2.0121 965	2.2521 916	2.5181 701	2.8126 648	3.1384 284
13	1.7721 9610	1.8856 491	2.1329 283	2.4098 450	2.7196 237	3.0658 046	3.4522 712
14	1.8519 4492	1.9799 316	2.2609 040	2.5785 342	2.9371 936	3.3417 270	3.7974 983
15	1.9352 8244	2.0789 282	2.3965 582	2.7590 315	3.1721 691	3.6424 825	4.1772 482
16	2.0223 7015	2.1828 746	2.5403 517	2.9521 638	3.4259 426	3.9703 059	4.5949 730
17	2.1133 7681	2.2920 183	2.6927 728	3.1588 152	3.7000 181	4.3276 334	5.0544 703
18	2.2084 7877	2.4066 192	2.8543 392	3.3799 323	3.9960 195	4.7171 204	5.5599 173
19	2.3078 6031	2.5269 502	3.0255 995	3.6165 275	4.3157 011	5.1416 613	6.1159 390
20	2.4117 1402	2.6532 977	3.2071 355	3.8696 845	4.6609 571	5.6044 108	6.7275 000
21	2.5202 4116	2.7859 626	3.3995 636	4.1405 624	5.0338 337	6.1088 077	7.4002 499
22	2.6336 5201	2.9252 607	3.6035 374	4.4304 017	5.4365 404	6.6586 004	8.1402 749
23	2.7521 6635	3.0715 238	3.8197 497	4.7405 299	5.8714 637	7.2578 745	8.9543 024
24	2.8760 1383	3.2250 999	4.0489 346	5.0723 670	6.3411 807	7.9110 832	9.8497 327
25	3.0054 3446	3.3863 549	4.2918 707	5.4274 326	6.8484 752	8.6230 807	10.8347 059
26	3.1406 7901	3.5556 727	4.5493 830	5.8073 529	7.3963 532	9.3991 579	11.9181 765
27	3.2820 0956	3.7334 563	4.8223 459	6.2138 676	7.9880 615	10.2450 821	13.1099 942
28	3.4296 9999	3.9201 291	5.1116 867	6.6488 384	8.6271 064	11.1671 395	14.4209 936
29	3.5840 3649	4.1161 356	5.4183 879	7.1142 571	9.3172 749	12.1721 821	15.8630 930
30	3.7453 1813	4.3219 424	5.7434 912	7.6122 550	10.0626 569	13.2676 785	17.4494 023
31	3.9138 5745		6.0881 006	8.1451 129	10.8676 694	14.4617 695	19.1943 425
32	4.0899 8104		6.4533 867	8.7152 708	11.7370 830	15.7633 288	21.1137 768
33	4.2740 3018		6.8405 899	9.3253 398	12.6760 496	17.1820 284	23.2251 544
34	4.4663 6154		7.2510 253	9.9781 135	13.6901 336	18.7284 109	25.5476 699
35	4.6673 4781		7.6860 868	10.6765 815	14.7853 443	20.4139 679	28.1024 369
36	4.8773 7846	5.7918 161	8.1472 520	11.4239 422	15.9681 718	22.2512 250	30.9126 805
37	5.0968 6049	6.0814 069	8.6360 871	12.2236 181	17.2456 256	24.2538 353	34.0039 486
38	5.3262 1921	6.3854 773	9.1542 524	13.0792 714	18.6252 756	26.4366 805	37.4043 434
39	5.5658 9908	6.7047 512	9.7035 075	13.9948 204	20.1152 977	28.8159 817	41.1447 778
40	5.8163 6454	7.0399 887	10.2857 179	14.9744 578	21.7245 215	31.4094 200	45.2592 556
41	6.0781 0094	7.3919 882	10.9028 610	16.0226 699	23.4624 832	34.2362 679	49.7851 811
42	6.3516 1548	7.7615 876	11.5570 327	17.1442 568	25.3394 819	37.3175 320	54.7636 992
43	6.6374 3818	8.1496 669	12.2504 546	18.3443 548	27.3666 404	40.6761 098	60.2400 692
44	6.9361 2290	8.5571 503	12.9854 819	19.6284 596	29.5559 717	44.3369 597	66.2640 761
45	7.2482 4843	8.9850 078	13.7646 108	21.0024 518	31.9204 494	48.3272 861	72.8904 837
46	7.5744 1961	9.4342 582	14.5904 875	22.4726 234	34.4740 853	52.6767 419	80.1795 321
47	7.9152 6849	9.9059 711	15.4659 167	24.0457 070	37.2320 122	57.4176 486	88.1974 853
48	8.2714 5557	10.4012 697	16.3938 717	25.7289 065	40.2105 731	62.5852 370	97.0172 338
49	8.6436 7107	10.9213 331	17.3775 040	27.5299 300	43.4274 190	68.2179 083	106.7189 572
50	9.0326 3627	11.4673 998	18.4201 543	29.4570 251	46.9016 125	74.3575 201	117.3908 529

11. What is the amount of $216.50 at 7% compounded annually for 9 years?

12. What is the compound interest of $785.40 at 8% compounded quarterly for 11 years?

13. What is the compound interest of $2367.25 at 10% compounded semi-annually for 17 years 6 months?

14. What is the compound interest of $6532.80 at 6% compounded quarterly for 6 years?

Find the principal that will yield at compound interest.

15. $578.81¼ in three years at 5%, compounded annually.

Note.—Divide the amount by amount of $1.

16. $7133.03 in 4 yrs. 3 mo. 8 days at 7%, compounded annually.

17. $1340.10 in 3 years at 10%, compounded semi-annually.

18. $780.32 in 2 years at 7%, compounded semi-annually.

19. $501.99 in 1 yr. 5 mo. 18 days at 6%, compounded quarterly.

20. $987.23 in 1 yr. 10 mo. 20 days at 8%, compounded quarterly.

21. $1495.77 in 3 yrs. 7 mo. 18 days at 5%, compounded semi-annually.

22. What is the difference between the simple interest and the compound interest at 8%, on a note of $450 for 4 years, no grace; interest compounded annually?

23. What is the difference between the annual interest and the compound interest at 10%, on a note of $660 for 2 yrs. 1 mo. 10 days, no grace; interest payable semi-annually, but not paid until maturity?

24. Find the difference between the annual interest and the compound interest at 9%, on a debt of $750 for 1 yr. 4 mo. 15 days; interest payable quarterly, but not paid until maturity.

25. What is the difference between the annual interest and the compound interest at 8½% on a note of $625 for 3 yrs. 4 mo. 18 da.; interest payable semi-annually, but not paid until maturity?

26. Find the difference between the simple and compound interest on $925.30 at 7%, for 15 yrs. 6 mo. 10 da., compounded semi-annually.

COMMERCIAL PAPER

353. *Commercial Paper* includes all written or printed documents used as representatives of money value, that can be transferred by indorsement, and consists of notes, drafts and checks.

354. A *Promissory Note* is a written promise, signed by the person promising, to pay a certain sum of money on demand or at a specified time for value received.

355. A *Draft* is a written order signed by one party, directed to another, ordering him to pay to a third party, or to his order, a certain sum of money, either at sight or at a specified time. Drafts drawn on parties in other states or countries are called Bills of Exchange.

356. A *Check* is a written order signed by a party having money in a bank, directing the bank to pay a certain sum to a certain party, or to his order, or bearer.

357. An *Indorsement* is a writing on the back of commercial paper, that

1. Transfers the ownership; or

2. Secures the payment; or

3. Acknowledges part payment.

358. The *Parties* to a commercial paper are:

1. The *Maker,* who signs a note.

2. The *Drawer,* who signs a draft or check.

3. The *Payee,* who is to receive the money.

4. The *Drawee,* to whom the order is addressed.

5. The *Indorser,* whose name appears on the back of the paper.

The *original parties* to commercial paper are those necessary to create the paper, or bring it into existence.

The *original parties* to a note are the maker and payee. The original parties to a draft or check are the drawer, drawee and payee.

The *subsequent parties* to commercial paper are the indorsers and indorsees.

The *holder* of commercial paper is the owner.

The *payer* is the party who is to pay the money to the payee, viz.: the maker of a note or the drawee of a draft or check.

The *face* of commercial paper is the sum made payable by the paper.

The *buyer* or *remitter* of a draft or bill of exchange is the party who sends or remits it as the equivalent of money.

359. A *Negotiable Note* is one that can be transferred under proper conditions and thus give the new holder the right to enforce it against the maker, irrespective of advance claims, set-offs or defences.

A *Non-Negotiable Note* is one that lacks some essential feature of a negotiable note, and can only be transferred so as to give the new holder such rights as the former holder had.

In order to be negotiable, commercial paper must be made payable to *order* or to *bearer*. Negotiable paper becomes non-negotiable after it is due.

Some states as Arkansas and Pennsylvania, and New Jersey require that paper in order to be negotiable must contain some such expression as "without discount," "without defalcation," or "without set-off." In these states the omission of these expressions would not affect the transferability but would affect the negotiability of the paper.

360. *Days of Grace* are three days allowed after the expiration of the time specified, before the paper is legally due.

Days of grace have been abolished in a majority of the states.

361. The *Maturity of Commercial Paper* is the day on which it is legally due.

362. In computing time, on commercial paper, the day of date is omitted and the day of maturity is included.

1. If the time is given in months, calendar months are meant.

Thus—Two months after January 5 ends with March 5.

2. If there are not as many days in the month in which the time ends as were given in the first month, the time never includes more than the last day of the latter month.

Thus—1 month after January 29, 30 or 31 ends with February 28 or 29.

3. If the time is given in days, the exact time must be computed.

Thus—60 days after December 15 ends with February 13.

4. The banks of the District of Columbia, Delaware, Maryland, Missouri, Pennsylvania, charge interest for the day on which a note is discounted and for the day on which it matures—making the interest period practically one day longer than in other states.

When the last day of grace falls upon Sunday or a legal holiday, in most states, the paper matures the previous day, but if this also should be Sunday or a legal holiday it is then payable one day earlier still. Where grace is not allowed, the date of maturity is a day later when the paper matures on a Sunday or legal holiday.

363. The *Indorsement* of commercial paper, to transfer ownership, may be either in *blank* or in *full*.

1. An *indorsement in blank* is simply the signature of the indorser.

2. An *indorsement in full* is an order over the signature of the indorser, to pay to some other party, or to the order of that party.

3. An indorsement in blank makes the paper payable to the bearer.

4. The indorser of a commercial paper guarantees its payment, and is liable for its payment to any subsequent holder, unless the words "without recourse," or words of similar import, precede his signature.

5. Commercial paper made payable *to bearer* need not be indorsed to transfer ownership; but, if

Made payable *to order*, it must be indorsed to transfer ownership.

364. A *Protest* is a formal statement made by a Notary Public, over his official seal that a note, draft or check has been properly presented for payment or acceptance, and the same has been refused.

Commercial paper must be legally protested to hold the indorsers liable for its payment.

In order to make a protest of commercial paper legal, the paper must be presented for payment on the day of its maturity, during business hours, at the place where it is payable; and, if no place of payment is specified in the paper, at the residence or place of business of the maker, during reasonable hours.

365. The *Acceptance* of a draft or check is the writing, by the drawee, across the face of the paper, the word "Accepted" and the date, followed by his signature.

If the drawee refuses to accept or to pay a check or draft, the holder must have the paper protested, to hold the drawer and indorsers liable for its payment.

A *sight* draft is one made payable at sight, or on demand.

A *time* draft is one made payable at a specified time after sight or after date.

When no time of payment is mentioned in commercial paper, it is payable at sight, or on demand.

To *honor* a draft or check is to accept it or pay it on presentation.

366. Promissory notes are named

1. From time of payment—as *demand notes* and *time notes*.

2. From the maker or makers—as *individual notes, joint notes* and *joint and several notes*.

3. From the words "with interest" or from their omission— as *interest-bearing notes* and *non-interest-bearing notes*.

All notes bear interest after they become due if not then paid, even though no mention of interest is made in them.

FORMS OF NOTES AND DRAFTS

367. *1.* PROMISSORY NOTE—SIMPLEST FORM

Chicago, Ill., Dec. 18, 1903.

Seven months after date we promise to pay Samuel B. Willey . . . . .or order, Seven Hundred and $^{no}/_{100}$ . . . . .Dollars.

Chas. W. Connors & Co.

What will be the amount due on the above note January 1, 1905, finding time by compound subtraction?

2. NOTE—INTEREST-BEARING

$865.38. *Detroit, Mich., June 20, 1905.*

Sixty days after date I promise to pay to Henry Graham, or order, Eight Hundred Sixty-Five and $\frac{38}{100}$ Dollars with interest at 7%. Value received.

David G. Lamont.

In finding the maturity of this note count 60 days after June 20.

What is the maturity of the above note? What amount will be due at maturity?

3.   NOTE—NON-INTEREST-BEARING

$1250.   *Philadelphia, Pa., Oct. 31, 1905.*

Four months after date I promise to pay Milton W. Townsend, or order, One Thousand Two Hundred Fifty Dollars. Value received, without defalcation.

Amos Cumming.

In finding the maturity of this note consult Art. 362. No interest will be due on this note at maturity, but if not paid then it will draw interest at the legal rate in the state where it is given.

What is the maturity of the above note? If it is not paid until July 10, 1906, what amount will then be due, including $1.75 protest fees?

4.   JOINT AND SEVERAL NOTE

$825.30.   *Omaha, Neb., May 15, 1903.*

On, or before March first, 1905, we jointly or severally promise to pay to Robert Brown & Co., or order, Eight Hundred Twenty-Five and $\frac{30}{100}$ Dollars, value received, with interest after six months.

Walter S. Thompson,
Isaac O. Sibley.

The above note is payable "on or before," which gives the payers the option of paying the note at their convenience at any time before due. In a joint note both makers must be sued together. A joint note reads "we promise," etc., while a joint and several note reads "we jointly or severally." In a joint and several note each maker is separately liable for the full amount of the note, and can be sued separately. Interest on the above note does not begin until six months after the date.

Suppose the above note is settled November 15, 1904. What amount must be paid?

5.   SIGHT DRAFT

$200.00.   *Cincinnati, Ohio, Dec. 16, 1905.*

At sight pay to the order of Andrew Wilson, Two Hundred
Dollars, value received, and charge to account of

To A. J. Cooper & Co., } *James W. Cameron & Co.*
         Detroit, Mich. }

In the state of Michigan sight drafts are allowed days of grace, hence
this draft should be accepted by A. J. Cooper & Co., by writing "Ac-
cepted" with date and signature across the face of the draft. The draft
will then be due three days after such acceptance.

6.   TIME DRAFT

$1739.00.   *Columbus, O., May 10, 1905.*

At thirty days sight pay to the order of Marshall Field &
Co., One Thousand Seven Hundred Thirty-Nine Dollars,
value received and charge to account of

To H. B. Claflin & Co., } *Wm. L. Churchill & Co.*
         New York.   }

Suppose the above draft is accepted May 16, 1905, when will
it mature?

PARTIAL PAYMENTS

368. A *Partial Payment* is a payment of a part of a note or
obligation.

369. An *Indorsement* in Partial Payments is the acknowledg-
ment of the payment, written on the back of the paper stating
the amount and the date of payment.

1.   PROMISSORY NOTE

$600.   *Chicago, Ill., May 1, 1903.*

On demand I promise to pay John Downing, or order,
Six Hundred Dollars, value received, with interest at 6%
from date.

                                      William Smith.

BACK OF NOTE SHOWING INDORSEMENTS

Aug. 12, 1903.
Received on the
within note
Seventy Five
Dollars ($75).

July 24, 1904.
Received on the
within note Two
Hundred Dollars
($200).

The above note was settled May 1, 1905. What was the amount due at settlement?

SOLUTION

Date	Time	Interest	Amount	Payment	Principal
May 1, 1903		6 %			$600
Aug. 12, 1903	3 mo. 11 da.	$10.10	$610.10	$75	$535.10
July 24, 1904	11 mo. 12 da.	$30.50	$565.60	$200	$365.60
May 1, 1905	9 mo. 7 da.	$16.88	$382.48	Ans.	

The foregoing problem has been solved according to the following rule adopted by the Supreme Court of the United States and hence called the

United States Rule

a. Find the amount of the given principal from the date of the note until the first payment; if the payment is greater than the interest, subtract the payment from the amount, and treat the remainder as a new principal. Thus continue until the date of settlement.

b. If the interest be greater than any payment, find the interest on the principal to a time when the sum of the payments exceeds the interest, subtract the sum of the payments from the amount of the principal, and treat the remainder as a new principal.

2. On a note dated January 1, 1903, for $300 bearing 6% in-

terest, the following indorsement was made: January 1, 1904, $70. What was due January 1, 1905?

3. On a note of $980 for 4 years at 8%, dated July 5, 1902, the following payments are made: March 7, 1903, $170; January 5, 1904, $25; April 20, 1905, $320. What is due at maturity, July 5, 1906?

4. The following payments were made on a mortgage of $1250 bearing 7%, dated October 20, 1903; $125 on January 29, 1904; $145 on April 8, 1904; $300 on September 20, 1904; $90 June 2, 1905. What was due November 6, 1905?

5. On a note dated July 15, 1903, for $1100 are the following indorsements: February 24, 1904, $200; March 30, 1905, $225; April 12, 1906, $250; June 6, 1907, $340. What is due September 1, 1907, interest at 9%?

6. A note of $900, bearing 10% interest, dated August 1, 1902, was indorsed as follows: November 13, 1902, $115; February 25, 1903, $125; June 7, 1903, $20; October 28, 1903, $200; January 1, 1904, $340. What was due April 25, 1904?

7. April 1, 1902, a note was given for $7500 at 5% interest. Payments were made on September 15, 1902, of $1000; on July 27, 1903, of $870; on March 6, 1904, of $2400; on August 27, 1904, of $1130. What was due February 18, 1905?

8. A note of $1575, bearing 6% interest, dated January 1, 1902, for 3 yrs. 8 mo., was indorsed July 20, 1902, $250; February 6, 1903, $200; January 10, 1904, $450. What was due at maturity?

9. A note of $1400, bearing 10% interest, dated May 1, 1905, for 2 yrs. 3 mo., was indorsed October 30, 1905, $300; June 22, 1906, $160; December 5, 1906, $200. How much was due at maturity?

10. A note for $10000 dated January 1, 1900, bearing 6% interest was indorsed as follows: May 1, 1900, $18; September 4, 1900, $20; December 16, 1900, $15; April 10, 1901, $21; July 13, 1901, $125; December 23, 1901, $324. What was due at the time of settlement, November 1, 1903?

370. The following rule is used by banks and generally by
17

merchants in finding the sum due on a note when partial pay-
ments have been made. The banker's interest is reckoned in this
rule.

Merchants' Rule

*a. Find the amount of the note from the time it was given
until the time of settlement.*

*b. Find the amount of each payment from the time it was
made until the time of settlement.*

*c. From the amount of the principal, subtract the amount of
the payments.*

1. On a note, dated Jan. 1, 1904, for one year, for $560,
interest 6%, the following payments were made: June 1, 1904,
$65, and Nov. 15, 1904, $100. Find the sum due at maturity.

In computing the interest under the Merchants' Rule, find
the exact time in days, and consider a year 360 days.

SOLUTION

Date	Time	Interest	Payment	Amount	Balance
		6%		$560.	
Jan. 1, '04—Jan. 1, '05	360 da.	$33.60		$593.60	$593.60
June 1, '04—Jan. 1, '05	214 da.	$2.32	$65.	$67.32	
Nov. 15,'04—Jan. 1,'05	47 da.	$ .78	$100.	$100.78	$168.10
				Ans.	$425.50

2. Find the sum due on December 10, 1905, on a note of
$900, at 6% interest, dated April 1, 1905, and indorsed July 6,
1905, for $240; September 12, 1905, for $420.

3. What sum is due November 17, 1905, on a note of $2850,
at 8% interest, dated March 12, 1905, and indorsed as follows:
May 30, 1905, $850; August 24, 1905, $700; October 6, 1905,
$470?

4. On a note, dated March 1, 1905, for 9 months, of $765, at 9% interest, the following payments were made: April 26, $140; June 20, $280; November 6, $295. Find the sum due at maturity.

5. A note for $1800 at 7% interest was given September 2, 1905, payments were made December 28, 1905, of $480; March 1, 1906, of $325; May 23, 1906, of $670. What was due at maturity, the time of the note being 10 mo. 12 days?

6. A note of $3500 with interest at 10%, dated October 30, 1905, was indorsed as follows: January 1, 1906, $1100; March 20, 1906, $390; June 2, 1906, $845. What was due September 16, 1906?

7. A note of $1780, bearing 8% interest, dated August 27, 1905, for 8 months, was indorsed on November 10, 1905, $275; on February 3, 1906, $600. What was due at maturity?

8. A note of $1065, bearing 6% interest, dated January 1, 1905, for 7 mo. 15 days, was indorsed on March 4, $200; on May 12, $180; on May 30, $300. What was the amount due at maturity?

9. What is the difference between the sum due by United States Rule and Merchants' Rule, on a note of $720, bearing 5% interest, dated February 2, for 8 mo. 10 days, and indorsed April 4, for $160; June 11, $210; August 1, $80?

10. Which is greater and how much, the sum due by United States Rule or the sum due by Merchants' Rule on a note of $810 at 10% interest, dated November 19, 1905, for 10 months, and indorsed January 1, 1906, for $230; March 16, 1906, for $60; April 4, 1906, for $360?

(11)

$1248. *Boston, Mass., December 11, 1905.*

Seven months after date, I promise to pay S. M. Mack, or bearer, Twelve Hundred Forty-eight Dollars. Value received, interest at 7% from date. Payable at Second National Bank.

R. S. Wilcox.

The following indorsements were made: January 25, $100; March 16, $350; April 16, $50; May 10, $225. What was due at maturity?

371. *Annual Interest with Partial Payments.*

In case interest is payable annually and partial payments have been made at irregular intervals, the following rule is the method of solution.

a. Find the interest on the principal for the first interest period, and find also the amounts of the payments made during this period, from the times they were severally made until the end of the period.

b. If the payments amount to more than the interest due, take their amount from the amount of the principal, and make the remainder a new principal.

c. But if the amount of the payments does not equal the interest due, the principal remains unchanged; and the amount of the payments is taken from the interest, the remainder being treated as deferred interest.

d. This deferred interest draws interest until it is paid, or until the note matures; and all payments apply; firstly, to interest on deferred interest; secondly, to deferred interest; and lastly, to interest just due, and principal.

1. What amount will be due on a note dated January 1, 1902, due in 5 years for $6000, drawing interest at 6% payable annually, the following payments having been made thereon: May 1, 1904, $500; September 1, 1906, $800.

2. A note for $1200, at 6% interest, payable annually, is dated June 16, 1900, and is to run five years. No interest having been paid except for the first year, and the following payments having been made, viz.: September 15, 1902, $250; March 10, 1904, $400. What amount will be due at maturity?

TRUE DISCOUNT

372. *Discount* is a deduction made for the payment of money before it is due.

373. The *Present Worth* of a debt due at a future time is its value now. The present worth of a debt is such a sum as, if put at interest, will amount to the debt at the expiration of the time.

374. *True Discount* is the difference between the present worth and the debt, and is called *true discount* because the method of computing it is in strict accordance with equity.

True discount is little used owing to the difficulty in computing it, and *bank discount* has almost become universal.

375. The *Face of the Debt* is the sum which will be due at the expiration of the time.

The Present Worth is a Principal which at the rate of interest for the time will amount to the debt.

The terms Present Worth, Face of Debt and True Discount correspond to Principal, Amount and Interest.

1. What is the present worth and true discount of a debt of $354 due in 3 yrs., money being worth 6%?

SOLUTION

1. 3 × $.06 = $.18.

2. Int. on $1 = $.18.

3. $1 + $.18 = $1.18 amount of $1.

4. $354 ÷ $1.18 = $300 present worth.

5. $354 — $300 = $54 true discount.

From this solution and explanation we have the following:

To Find the True Discount

a. Divide the face of the debt by the amount of $1 for the given time and rate, and the result will be the present worth.

b. Subtract the present worth from the face of the debt and the difference will be the true discount.

Note.—In the following problems the rate per cent. is 6, unless some other rate is given.

2. I owe $191.08, due in 1 yr. 6 mo. 18 days. I am allowed true discount at 8%. Find the sum that will pay the debt now.

3. What sum will pay a debt of $1098.39, due in 2 yrs. 9 mo. 21 days, money being worth 6%?

4. My note of $1035.99, due in 3 yrs. 1 mo. 6 days, was purchased by B at 9% true discount. What did he pay for the note?

5. L. B. Jones owes $1657.50, due in 5 yrs. 11 mo. 3 days. He borrowed the money to pay same, being allowed 4% true discount. How much did he borrow?

6. If Parker pays a debt of $151.27, due in 1 yr. 1 mo. 24 days, with corn at 35 cents per bushel, how many bushels will be required, money being worth 7%?

7. Brown gave his note for $470, and cash for remainder of a debt of $1073.50, due in 2 yrs. 2 mo. How much cash did he pay, if he was allowed 6% true discount on the debt?

8. I gave Smith a horse in payment of a debt of $193.60, due in 8 mo. 12 days. I was allowed 10% true discount on the debt, and thus gained 20% on the cost of the horse. What did the horse cost me?

9. A merchant purchased a bill of goods for $260 on 6 months' time, or $245 for cash. If money is worth 8%, will he gain or lose and how much if he pays cash?

10. A jobber paid $274 cash for a lot of merchandise, rather than give his note for $297.30 for 1 yr. 6 mo. If money was worth 7%, what did he lose by paying cash?

11. A merchant bought a bill of goods for $760 on 1 year's time, or with a trade discount of 2 and 5% for cash. He accepted the cash offer. Did he gain or lose, money being worth 6⅔%?

12. I bought $721 worth of wheat on 4 months' time, and sold it on same day at 12% advance. I paid the present worth of the debt from the proceeds, being allowed 9% true discount. How much did I gain by the transaction?

13. A wholesale merchant sold a bill of $1020 at a trade discount of 20 and 12½%, and allowed a credit of 90 days. He accepted cash payment allowing true discount at 8%. What was the cash payment?

14. A retail merchant bought a bill of goods amounting to $360 at a trade discount of 10 and 5%. He sold the goods at 20% profit on the invoice price and allowed a credit of 6 months. What was his net gain, money being worth 10%?

15. I sold goods for $1134, and allowed 7 mo. 15 days credit. The purchaser paid me cash at true discount of 8%. I invested the proceeds in wheat at $1.20 per bushel. How many bushels did I buy?

BANK DISCOUNT

376. *Bank Discount* is the simple interest paid in advance on a note or draft for the time the paper has to run.

Bank Discount may be computed by either of the methods of reckoning interest, but in the case of notes discounted in banks, and call loans on Wall street banker's interest is used.

377. The *Proceeds* of a note or draft is the sum received from the bank for it or the face of the paper less the bank discount.

In case the paper is drawing interest. the amount due at *maturity* is the *face* of the paper and on this the discount should be computed.

378. The *Term of Discount* is the time from the date of discount to the maturity of the paper.

In finding the term of discount the usual custom is to exclude the day on which the paper is discounted. but include the day of maturity. Thus on a note discounted June 10, due June 25, the term of discount would be 15 days. This custom is not universal however, and banks in Baltimore, Philadelphia and few other cities. charge for the day of discount, also, making in the above example 16 days as the term of discount.

In computations in bank discount. five quantities are considered, viz.: *Face of Debt, Rate of Discount, Term of Discount, Bank Discount* and *Net Proceeds.*

In the following problems, do not use grace and count exact days for term of discount.

379. *To find the bank discount and proceeds of a note or debt.*

1. Find the bank discount and the proceeds of a note of $240 at 6% discount, dated January 10, 1903, for 4 mo. 27 days.

<div align="center">SOLUTION</div>

Jan. 10 + 4 mo. 27 da.	= June 6.
From Jan. 10 to June 6	= 147 da.
Face of note	= $240.
Int. on $1 for 147 da. at 6%	= .0245.
Bank discount	= $5.88.
Proceeds = $240 — $5.88	= $234.12.

From this solution and explanation we have the following:

To Find the Bank Discount

a. Find the term of discount in exact days.

b. Find the interest on the face of the note for the term of discount and this will be the bank discount.

c. Subtract the discount from the face of the note to find the net Proceeds.

Note.—If a note is on interest, find its *amount* at maturity, and taking this as the *face* of the note, cast the interest on it as above.

Find the bank discount of the following notes (no interest):

2. $325, dated March 4 for 2 mo. 26 days, discounted March 18 at 5%.

3. $870, dated May 1 for 27 days, discounted May 11 at 9%.

4. $465, dated April 16, for 1 mo. 12 days, discounted April 27 at 7%.

5. $1282.50, dated February 19, 1905, for 3 mo. 4 days, discounted March 23 at 8%.

6. $1848, dated January 27, 1905, for 4 mo. 2 days, discounted at 10% on the day of making.

Find the proceeds of the following non-interest-bearing notes:

7. $920, dated January 10, 1905, due in 30 days, discounted January 10 at 10%.

8. $465, dated March 4, 1905, due in 60 days, discounted March 15 at 9%.

9. $2725, dated November 12, 1905, due in 90 days, discounted November 17 at 5%.

10. $194.80, dated September 4, 1905, due in 45 days, discounted September 4 at 6%.

Find the date of maturity, term of discount, bank discount and proceeds of the following notes.

(11)

$280.   CHICAGO, ILL., March 12, 1905.

Four months after date, I promise to pay to R. T. OWENS, or order, Two Hundred Eighty Dollars. Value received.

                                        F. S. Cox.

Discounted May 20, 1905, at 7%.

(12)

$970.   LANSING, MICH., August 25, 1905.

Six months after date, I promise to pay to the order of G. H.
GRAHAM, Nine Hundred Seventy Dollars. Value received. Interest at 5% from date.

C. H. SMITH.

Discounted November 6, 1905, at 7%.

NOTE.—Find the amount due at maturity, and compute the discount on
this amount from November 6, to maturity.

(13. JOINT NOTE)

$1280.   LOUISVILLE, KY., January 1, 1905.

Nine months after date, we promised to pay E. H. DURANT, or
bearer, Twelve Hundred Eighty Dollars. Value received, with
interest at 8% from date.

THOMAS SMAILS.
J. D. PETERS.

Discounted July 15, 1905, at 6%.

(14. SEVERAL NOTE)

$1968.40.   FREMONT, NEB., June 5, 1905.

One year after date, either of us promises to pay R. D. ALLEN
& Co., or order, Nineteen Hundred Sixty-eight $\frac{40}{100}$ Dollars.
Value received, with interest at 7%. Payable at the Merchants
Bank.

G. H. MAHLER.
O. A. PRESTON.
J. B. ROSS.

Discounted April 1, 1906, at 10%.

(15. JOINT AND SEVERAL NOTE)

$292.50.   CHICAGO, ILL., July 14, 1905.

Nine months and twelve days after date, we or either of us,
promise to pay to the order L. P. DERN, Two Hundred Ninety-two $\frac{50}{100}$ Dollars. Value received, with interest at 9%.

J. F. SOMERS.
P. R. CORBIN.
A. C. WILSON.

Discounted January 1, 1906, at 8%.

16. Find the proceeds of a note of $275, bearing 6% interest,
dated March 19, 1905, payable in 3 months; discounted April 16,
at 8%.

17. I held B's note of $1760, bearing 10% interest, dated February 6, 1905, for 5 months, 10 days, and discounted same May 1, 1905, at 6%. How much did I receive from the bank?

18. A merchant who had a credit of $368.72 at the bank, had the proceeds of the following note placed to his credit: $628.80, bearing 8% interest, dated January 17, 1905, for 7 months, discounted April 2, 1905, at 8%. What was his credit then?

19. Lyman discounted a note of $1600, bearing 10% interest, dated April 3, 1905, for 10 months; discounted August 12, 1905, at 7%. How much was left after paying with the proceeds a note of $630, that had been on interest 2 years at 8%?

20. For what sum must I give my note for 60 days to receive $600 proceeds, if the note is discounted at 8%?

NOTE.—Since the proceeds of $1 at 8% for 60 days is .986⅔ it will require as many dollars to produce $600 proceeds as .986⅔ is contained in $600 or $608.11.

21. I received $711 from a bank on a 90 days' note, at 5% discount. What was the face of the note?

22. What must be the face of a note for 105 days, to give $536.80 proceeds when discounted at 10%?

23. $1186.50 was the proceeds of a note, dated January 18 for 4 months, and discounted April 3, at 9%. What was the face?

24. The discount on a note, dated February 6 for 6 months, and discounted July 7 at 10% is $12.50. Find the face and the proceeds of the note.

NOTE.—Divide the discount by the discount on $1, to find the face of the note.

25. Smith's note, dated March 1 for 4 mo. 15 days was discounted May 2 at 7%. What was the face of the note, if the discount was $5.25?

26. I received $581.55 at the bank for my note due in 90 days. The bank charged me 8% discount. What was the face of the note?

27. For what sum must I give my note at the bank for 2 mo. 9 da. to receive $1176, if the bank charges 9% discount?

STOCKS AND BONDS

380. *Stocks* represent the capital or property of an incorporated company.

381. An *Incorporated Company* is an association authorized by law to transact business as a single individual.

382. *A Charter* is a legal instrument defining the powers and duties of a corporate body.

383. The *Capital Stock* is the funds or capital of the corporation.

384. A *Share* is one of the equal parts of the stock. A share is usually $100, though it may be of any value agreed upon by the members of the corporation.

385. A *Stock Certificate* is a paper issued by a corporation stating the number of shares to which the holder is entitled, and the par value of each share.

386. The *Par Value* of stock is the value named in the certificate.

387. The *Market Value* of stock is the price per share for which it sells.

388. Stock is *At Par* when it sells for its face value.

389. Stock is *Above Par* when it sells for more than its face value, and *Below Par* when it sells for less than its face value.

390. *Preferred Stock* is that which takes preference over *common* stock in reference to dividends.

Preferred Stock is issued as a special inducement to raise money or to protect a certain class of shareholders who may have advanced money to relieve a company from embarrassment.

391. A *Dividend* is the sum paid to stockholders from the gains of the corporation.

392. *Assessments* are sums levied on stockholders to meet the expenses or losses of the corporation.

393. A *Stock Broker* is a person who buys and sells stock as an agent for others.

394. *Brokerage* is the sum paid to brokers for buying and selling stock.

395. *Quotations of Stock* are statements made giving the price at which stock is being bought and sold. Stock quoted at $105\frac{1}{2}$ is selling at $5\frac{1}{2}\%$ premium, at $87\frac{1}{2}$ is selling at $12\frac{1}{2}\%$ discount.

Margin is cash or other security deposited with a broker on account of either the purchase or sale of securities, and to protect him against loss in case the market price of the securities bought or sold varies so as to be against the interests of the customer. It is usually 10% of the par value of the stock.

NOTE.—Brokers charge interest on the sums expended and purchase commission, and allow interest on the margins deposited, or preferably they charge interest on the debit balance.

A *Bear* is an operator who believes the market price of stocks will *fall*.

A *Bull* is an operator who believes the market price of stocks will *advance*.

NOTE.—Hence a bull will *buy* stocks in order to profit by the *higher* price at which he expects to *sell*, and a bear will *sell* in order to profit by the *lower* price at which he expects to *buy*.

Hypothecating stocks and bonds is depositing them as collateral security for money borrowed.

NOTE.—The securities must be *greater* than the loan by at least 10% of their par value, and in every case by an amount equal to 20% of the amount of the loan. This excess is called the *margin* of the loan.

Watering Stock is increasing the number of shares of an incorporated company without a corresponding increase in their value.

A *Corner* is produced when one or more operators owning or *controlling all* the stock of a company are able to purchase still more for either immediate or future delivery. When they demand the stock, the sellers are unable to find it in the market.

396. A *Bond* is a written or printed obligation of a city, county, state, government or corporation, promising to pay a certain sum of money at a specified time.

The object of a bond is to secure payment of borrowed money. When a city, state, etc., borrows money it gives a Bond as a certificate of the indebtedness.

397. A *Coupon Bond* is one having interest certificates or coupons attached. They are transferable merely by delivery, and for this reason are preferred for purposes of investment.

398. A *Registered Bond* is one payable to the holder, and is registered in the books of the authority issuing it. It can be transferred by assignment only.

Bonds are named from the authority that issued them, their rate of interest, and their date of maturity. U. S. "4's of 1907" are bonds issued by the United States, bearing 4% interest and maturing in 1907. Chicago "3's of 1900" are bonds issued by the city of Chicago, bearing 3% interest and maturing in 1900.

399. *Government Bonds* were issued to secure the payment of money borrowed to meet the expenses of the civil war.

400. The *Interest* on bonds is usually paid quarterly or semi-annually.

401. The *Interest* on Government (U. S.) bonds is payable in gold, and is reckoned by the method of exact interest.

402. The *Interest* on all bonds except U. S. bonds is payable in currency, and is reckoned by the method of common interest.

403. A *Mortgage* is a conveyance of real estate or other property, as a pledge to secure the payment of a certain debt.

When money is borrowed to build a railroad or for other purpose, the payment of the bonds is secured by a mortgage or deed of trust upon the real estate of the road made in favor of some bank or trust company as trustee.

Computations in Stocks and Bonds are based upon the principles of Percentage, and embrace five quantities, viz.: *Par Value = Base; Rate of Premium or Discount = Rate; Premium or Discount = Percentage; Market Value above par = Amount; Market Value below par = Difference.*

NOTE.—The par value of all stocks and bonds in the following problems is $100 unless otherwise stated.

ORAL PROBLEMS

1. What is the par value of 25 shares of stock? 75 shares? 125 shares? 4 shares?

2. What is the par value of 50 half shares of stock? 25 shares? 75 shares? 125 shares?

3. What is the value of 40 quarter shares of stock? 50 shares? 75 shares?

4. What puts stock at a premium? at a discount?

5. What is the premium at $6\frac{1}{4}\%$ on 100 shares of stock? 120 shares? 40 shares?

6. What is the discount at $12\frac{1}{2}\%$ on 240 shares of stock? 20 shares?

7. What is the brokerage at $\frac{1}{8}\%$ on stock, the par value being \$7200? \$400?

8. What will 20 shares of bank stock cost at 125 and brokerage at $\frac{1}{4}\%$?

9. What is the brokerage on 40 shares of stock, market value $124\frac{7}{8}$, brokerage at $\frac{1}{8}\%$? What is the cost?

10. I send my broker \$5000 and instruct him to buy 40 shares of railroad stock at 150, the value increases and I direct him to sell at 175. How much has he to my credit, brokerage in each case at $\frac{1}{8}\%$?

WRITTEN PROBLEMS

1. A corporation made an assessment of 9%. How much will a stockholder who holds 42 shares of stock pay?

2. I sold 38 shares of city bank stock at 8% premium. Find the amount above par I received.

3. A sold 54 shares of stock at 5% discount. For how much below par did he sell the stock?

4. 33 shares of Rock Island stock were sold at $107\frac{1}{2}$. Find the amount of premium received.

5. B received a dividend of $6\frac{3}{4}\%$ on 27 shares of Missouri Pacific stock. What was the amount of the dividend?

6. Smith was assessed 13% on 19 shares of mining stock. Find the amount of his assessment.

7. What assessment is paid by the holder of 45 shares of Western Union stock, if the rate is $4\frac{3}{5}\%$?

8. Bailey sold 78 shares of New York Central stock at $129\frac{1}{4}$. Find amount above par value he received.

9. Barton sold 46 shares, par value \$50, at a discount of $9\frac{1}{2}\%$; and 72 shares, par value \$25, at a discount of $7\frac{4}{5}\%$. Find the total sale.

Note.—Multiply the par value by the cost of $1 worth of the stock, to find the market value.

10. Find the selling price of 75 shares of stock, sold at $8\frac{3}{5}\%$ discount.

11. What is the selling price of 17 shares of stock at a discount of $3\frac{2}{3}\%$?

12. A paid $14\frac{1}{3}\%$ premium on 66 shares of mining stock. What did the stock cost him?

13. I sold through a broker 45 shares of Wabash stock at $8\frac{1}{5}\%$ discount, brokerage $\frac{1}{8}\%$. What amount did I receive?

14. B's broker bought 15 shares of railroad stock at a discount of 19%, and charged $\frac{3}{4}\%$ for buying. How much did the stock cost B?

15. Lyman bought 18 shares of stock at $5\frac{1}{3}\%$ discount and sold them at 13% premium. How much did he gain by the transaction?

16. I purchase 30 Chicago city 5's at 5% discount. How much less than the face did I pay for the bonds?

17. A purchased through his broker 18 U. S. 4's at $122\frac{2}{3}$, brokerage $\frac{1}{4}\%$. How much more than the face did he pay for the bonds?

18. If Cook County bonds are selling at 93, what is the discount and selling price of $3600 of the bonds?

19. Find the proceeds of the following bonds allowing $\frac{1}{4}\%$ brokerage: 100 U. S. $4\frac{1}{2}$'s of 1891 at $103\frac{3}{4}$; 75 Chicago 6's of 1890 at $103\frac{1}{2}$; 125 P. Ft. W. R. R. ($50), bonds at $44\frac{1}{2}$.

20. My broker bought for me 38 shares of bank stock at 92, and sold the same for 103. He charged $\frac{1}{4}\%$ for buying and selling. How much did I gain?

21. Brown bought through a broker 52 shares of stock at 16% discount. He paid an assessment of 4% and then sold at 98. How much did he gain, the brokerage being $\frac{1}{8}\%$ for buying?

22. A broker bought on his own account 93 shares of I. C. R. R. stock at $95\frac{1}{4}$. He received a dividend of 5%, and then sold his stock at a premium of 6%. Find his gain.

23. Find the cost of the following bonds allowing $\frac{3}{4}\%$ brokerage: 35 U. S. 4's of 1907 at $123\frac{3}{4}$; 80 Chicago $4\frac{1}{2}$'s of 1900 at $107\frac{1}{2}$; 25 Cook County 5's of 1895 at $103\frac{1}{4}$; 60 Western Union Telegraph 6's of 1911 at $87\frac{3}{8}$.

24. I bought 35 Illinois state bonds at 84, and sold them at 105 after having received 3% interest. What was my whole gain, and rate of interest on the investment?

25. How many shares of stock does a man own whose dividend is $468, the rate of dividend being 6%?

NOTE.—Since $6\% = \$468$, 1% will $= \$78$, and $100\% = \$7800$.

26. N. W. R. R. stock is selling at 5% above par. How many shares does a man buy, who pays $135 more than par value?

27. The dividend was $198 and the rate of dividend was 6%, find the par value.

28. I received a dividend of $348.50. The rate of dividend was $8\frac{1}{2}\%$. Find the number of shares I own.

29. An assessment of $3\frac{3}{8}\%$ was $47.25, find the par value.

30. A dividend at $2\frac{1}{5}\%$ was $210. What is the market value of the stock at a premium of 22%?

31. A speculator paid $259 premium on stock that sold at 7% above par. He sold the stock at a gain of 9%. What did he receive for it?

32. A broker bought C., B. & Q. R. R. bonds at $93\frac{1}{4}$, and paid $1350 less than the face of the bonds. How many bonds did he buy and what did they cost?

33. Bought at $107\frac{3}{4}$, Cook County bonds and paid, including $\frac{1}{8}\%$ brokerage, $1125 more than the face of the bonds. How many $50 bonds did I buy?

34. B paid $21593.75 for 25 $1000 U. S. $4\frac{1}{2}$'s. What was the quotation of the bonds?

NOTE.—Divide the market value by the par value.

35. A speculator paid $4284.50, including brokerage $\frac{1}{8}\%$, for 38 C. M. & St. P. 6's of 1910. What was the quotation of the bonds?

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36. A paid $360 premium on 45 $100 U. S. 4½'s. What was the rate of premium?

37. How many U. S. 4's of 1907 of $50 each at 97, can be bought for $2917.50, allowing ¼% brokerage?

38. What is the face value of U. S. 4½'s, that cost $19688.75 at 103½, brokerage ⅛%?

39. I paid $3315 for Chicago 5's at 10½% premium. How many $50 bonds did I buy?

40. How many $25 bonds can be bought for $1254.50 at 33% discount, brokerage ⅛%?

41. Jones sold 15 $100 R. R. 4's at 15% above par, and invested proceeds in mining stock at 13¾% discount. How many $50 shares of the latter did he receive?

42. What is the rate per cent. on investment, if U. S. 4's are purchased at 125?

43. What rate will I receive on my investment, if I invest $2940 in Cook County 5's at 98?

44. State 5's are purchased at 12½% premium. What rate is realized on the investment?

45. I invested $2175 in city 5's at 87. I sold the same at 92½ after receiving the interest for one year. What was my gain and rate of income on investment?

46. Bought U. S. 4½'s at 107½. I sold same at 10% premium after receiving three quarterly payments of interest. What was the rate of income on the investment?

47. I invested $3440 in U. S. 4½'s at 107½, $2694 in U. S. 4's at 112¼ and $4116 in Illinois 6's at 85¾. What was my annual income, and rate per cent. on investment?

48. Which is the more profitable investment, a stock at 125, paying 8% annually, or a bond at 90, paying 6% annually?

49. Three companies, A, B and C, are to be consolidated on the basis of the relative market values of their stock.

Thus, A's capital $1,000,000, market value 100% ;

B's capital $1,500,000, market value 50% ;

C's capital $625,000, market value 40%

The capital of the consolidated company is to be $2,000,000,

in 20000 shares of $100 each. What proportion and what amount of the capital should be allotted to each of the old companies; and how much stock in the new company should the holder of 1 share of the stock of each of the old companies be entitled to?

50. When 3% government bonds are quoted at 101, what sum must be invested to yield an income of $810 a year?

51. Bought October 12th, 400 Pacific Mail at 42¼, and 200 Michigan Central at 92½; November 10 sold the former at 42⅞, and the latter at 92¾; what was my gain not considering interest?

52. Which would be the better investment, $12120 in N. J. Central at 80, paying 3% annual dividends, or the same invested in Chemical Bank stock at 2020, paying 15% every 2 months?

53. A customer deposited $500 margin with a broker November 23, who purchased for him 50 shares Michigan Central at 80. He sold the same stock November 30 at 98; what was the gain, brokerage ⅛%?

STATEMENT

	Dr.				
Nov. 23.	To 50 sh. Mich. Cen. at 80... $4000				
	Brokerage ⅛%.......... 6.25	4006	25		
Nov. 30.	Int. on $4006.25, 7 days at 6%	*	**	****	**
	Cr.				
Nov. 23.	By margin deposited..............	500			
Nov. 30.	By 50 sh. Mich. Cen. at 98.... $****				
	Less Brokerage ⅛% ..... *.**	****	**		
Nov. 30.	Int. on $500, 7 days...........		**	****	**
		Balance.....		****	**
		Less margin		500	
		Gain........		***	**

NOTE.—The brokerage, ⅛ of 1% is equal to $12.50 on 100 shares of stock at the par value of $100 each.

54. July 10 deposited with my broker $800 margin for purchasing 60 shares Mo. Pacific R. R. stock at 92¼. The stock was sold July 28 at 95⅞. Allowing 6% interest on the deposit and charging 6% interest on the purchase and ⅛% brokerage. What was my net profit?

55. If a certain stock yields a dividend of 15% per annum, what is its value when money is worth 8%?

56. On May 7, I deposited with my broker $2000 margin, and instructed him to buy stocks. The same day he bought for my account 300 shares N. Y. Central at 118¾. He sold the stock May 26, at 122½. Interest 6%. brokerage ⅛%. What was my gain?

57. June 14, I "margined" $2000 and sold "short" through my broker 200 shares Mich. Cen. at 90 and June 28 "covered" my "short" at 86¾. Brokerage, ¼%. Int., 6%. Find gain.*

58. A speculator deposited with his broker $800 margin April 16. who purchased 40 shares B. & O. at 114¾. He sold the stock June 5 at 118⅝: find gain or loss, interest 6%, brokerage ⅛%.

59. A capitalist received his quarterly interest on 4½% bonds amounting to $382.50 and then sold the same at 105½. What were the net proceeds of the sale, brokerage ⅛%?

60. On July 10, I deposited with my broker $1200 margin with directions to buy Western Union stocks. The same day he purchased for my account 200 shares Western Union at 116¾. He sold the stock August 16 at 112½. Interest 7%. brokerage ⅛%. What was my loss?

61. If stock actually worth $88 per share be watered by issuing a stock dividend of 10%. what is the actual value of the watered stock?

62. An investor owned the following list of securities:

NATURE	PAR VALUE	COST	RATE
Bank Stock,	$2500	190	8%
Personal Note,	1400	Par	6%
Personal Note,	500	Par	6%
Real Estate Mortg.,	1800	Par	6%
Elec. Ry. Bonds,	1000	99½	5%
Gas Bonds,	3000	100	5%

What was his per cent. of income on the entire investment considered as one? What was his per cent. of income on his investment in the bank stock? What was the total investment?

* It is not a general custom among brokers to allow interest on margins advanced for "short" sales, but it is sometimes done and problem 57 is to be solved on this basis.

EXCHANGE

404. *Exchange* is a method of making payments between persons in different cities by means of drafts.

If a party in Chicago desires to remit a sum of money to a party in New York, he buys of a Chicago bank a draft on a New York bank and sends it to the party in New York. The New York party indorses the draft and presents it for payment to the bank on which it is drawn, either directly or through some other bank.

405. *Domestic Exchange* or *Inland Exchange* is the exchange between places in the same country.

406. *Foreign Exchange* is the exchange between places in different countries. A foreign draft is called a Bill of Exchange.

407. Exchange is *At Par* when the cost of a draft equals its face; *above par* or at a *premium*, when the cost of a draft exceeds its face; and *below par* or at a *discount* when the cost of a draft is less than its face.

Time drafts or bills of exchange are subject to bank discount on their face value for the time specified.

An *Acceptance* is the written promise of the *Drawee* to pay the draft when due. A *Draft* is accepted by the *Drawee's* writing across its face the word "Accepted" followed by the date of the acceptance and his signature.

408. The *Balance of Trade* between two places or countries is the difference between the amounts which each owes the other.

Thus if the banks of New York owe the banks of London $40,000,000 and the banks of London owe the banks of New York $35,000,000, the *balance of trade is* $5,000,000 *against* New York and in *favor* of London.

409. The *Course of Exchange* between two places is the price paid at one place for drafts on the other. The course of exchange is above or below par, according as the balance of trade is against or in favor of it.

A person may properly remit money:

1. By sending a Post Office money order or express money order, for small amounts. These are in effect drafts, but are sold at schedule prices, and not on principles of percentage.

2. By sending the actual money by express or otherwise.

3. By remitting a draft drawn on any bank in the city where the money is payable or some place that is recognized as a center of exchange.

New York is the recognized center of financial transactions in the United States as London is of the world.

DOMESTIC EXCHANGE

410. *Domestic Exchange* relates to payments between cities of the same country.

Computations in exchange are based upon the principles of percentage and embrace four quantities, viz.: *Face of Draft = Base; Rate of Exchange = Rate; Premium or Discount = Percentage; Cost of a Draft = Amount or Difference.*

ORAL PROBLEMS

1. Find the exchange at $\frac{1}{8}\%$ premium on the following drafts: $640, $720, $400, $320.

2. Find the exchange at $\frac{1}{8}\%$ discount on the following drafts: $200, $300, $400, $3000.

3. What will the following drafts cost at a premium of $\frac{1}{4}\%$: $200, $1500, $250.

4. Find the cost of the following drafts at a discount of $\frac{1}{4}\%$: $80, $250, $320, $480, $75.

5. I buy a bill of goods amounting to $200, if cash is paid at once a discount of 10% will be allowed. I at once buy a bank draft at a premium of $\frac{1}{4}\%$. What do the goods cost me?

WRITTEN PROBLEMS

1. Find the cost of a draft for $560 at $\frac{1}{8}\%$ premium.

2. Find the cost of a draft for $725 at $\frac{1}{2}\%$ premium.

3. Find the cost of a draft for $1316 at $\frac{5}{8}\%$ discount.

4. Find the cost of a draft for $1867.50 at $1\frac{1}{2}\%$ discount.

5. Find the cost of a draft for $620 at $1\frac{1}{4}\%$ premium.

6. Find the cost of a draft for $2860 at $1\frac{1}{2}\%$ discount.

7. A merchant in Boston bought a draft on Detroit at $\frac{4}{5}\%$ discount. If the face was $290, what was the cost of the draft?

8. I remit a draft of $480 to B on account, the rate of ex-change being $\frac{1}{2}$% premium. What was the cost?

9. I owed Lyman of Hartford $250. He allowed me a discount of 10%, and I remitted a draft in payment. Find cost of the draft at $\frac{2}{3}$% discount.

10. Brown bought 20 shares stock at 93, and paid for same by draft at $\frac{3}{8}$% premium. How much did the draft cost him?

11. I sent a draft to my agent to buy 1200 bu. of wheat at 75 cents per bu., at 3% commission. I paid $\frac{1}{8}$% premium on the draft. What was the cost?

12. A retail merchant bought a bill of $684 on 3 months' time, or 10 and 5% off for cash. He accepted the cash offer and remitted in payment a draft at $\frac{3}{4}$% premium. What did the goods cost him?

13. Find the face of a draft that cost $875 at $1\frac{1}{4}$% premium.

NOTE.—Since a draft for $1 cost $1.01¼, $875 will buy as large a draft as $1.01¼ is contained times in $875.

14. Find the face of a draft that cost $325.60 at $\frac{1}{4}$% discount.

15. Find the face of a draft that cost $1275.60 at $1\frac{1}{2}$% premium.

16. Find the face of a draft that cost $329.45 at $2\frac{1}{8}$% premium.

17. A merchant paid $932.40 for a draft on Nashville at $\frac{4}{5}$% premium. Find the face of the draft.

18. The cost of a draft at $1\frac{1}{2}$% discount on Albany was $364.45. What was the face of the draft?

19. A sight draft on St. Louis cost $459.42 at $1\frac{1}{5}$% discount. For what sum was the draft drawn?

20. What is the cost of a draft for $1200 on Omaha for 60 days at $\frac{1}{2}$% discount, interest at 8%?

NOTE.—Proceeds of $1 for 60 da. at 8% = $.986⅔ — $.005 discount = $.981⅔, cost of a draft for $1. A draft for $1200 will cost 1200 times as much.

21. Find the cost of a 75-day draft drawn on Pittsburg for $1860. The rate of exchange is $\frac{2}{3}$% premium and interest 6%.

22. I remitted to a creditor a draft for $275 at $\frac{4}{5}$% discount. The draft was at 15 days' sight, interest 6%. Find cost.

23. Davis remitted a 45-day draft in payment of a bill of $5760; the exchange was $\frac{3}{8}$% premium and interest 5%. What did he pay for the draft?

24. What is the cost of a draft for $6840, drawn at 27 days on Albany, if the exchange is $\frac{3}{8}$% discount and interest 6%?

25. How much must I pay for a draft of $340 on Boston for 51 days at $\frac{3}{8}$% discount, if money is worth 10%?

26. B sold me a horse that cost him $120, at $13\frac{1}{3}$% gain; I paid for same with a New York draft at $\frac{1}{4}$% discount, for 69 days at 7% interest. What was the net cost of the horse to me?

27. I bought a draft drawn on Boston for 18 days at $\frac{5}{12}$% discount. How much did the draft cost me, the face being for $1238.40, and money loaning at 6% interest?

28. A grain dealer bought wheat at 90 cents per bushel, and remitted for same a Chicago draft bought for $1344.60 at $\frac{2}{5}$% discount. How many bushels of wheat did he buy?

29. I paid $475.80 for a bank draft at $\frac{3}{4}$% discount, to send a wholesale merchant for a bill of goods bought at a discount of 6% from the invoice price. Find the invoice price.

30. A paid $584.70 for a New Orleans draft at $1\frac{1}{2}$% discount for 60 days, interest 6%. Find the face of the draft.

31. A merchant bought a 15-day draft for $961.50. What was the face of the draft, if exchange was $1\frac{3}{8}$% premium and interest 4%?

32. The cost of a New York draft at $1\frac{1}{2}$% premium, for 105 days was $433.40. What was the face of the draft, money being worth 5%?

33. A 60-day draft at $1\frac{3}{8}$% discount was remitted for payment of potatoes bought at a gain of 10% to the seller. What did the goods cost the seller, the draft costing $117.30 at 6%?

34. When exchange was at $\frac{3}{4}$% discount, and money loaning at 8%, Lyman paid $1773.30 for a Chicago draft, drawn at 33 days' sight. What would the draft cost him, if exchange was at $\frac{5}{8}$% premium?

35. I bought mining stock at 31% discount, and remitted in payment a bank draft at 1⅖% premium, that cost $1380. How many shares did I buy, the time of the draft being 72 days and interest at 7%?

FOREIGN EXCHANGE

411. *Foreign Drafts* or *Bills of Exchange* are usually expressed in the money of the country on which they are drawn.

Drafts drawn on persons and banks located in England, Ireland and Scotland, are expressed in pounds, shillings and pence; on France, Belgium or Switzerland in francs; on Germany, in marks, etc.

412. The *Par of Exchange* is the value of the money of one country expressed in the denominations of another.

1. The *intrinsic par* of exchange is the value of the coin of one country in the coin of another, based upon the relative weight and fineness of the two coins.

2. The *commercial par* of exchange is the market value of the currency of one country as compared to that of another.

413. Foreign bills of exchange are usually drawn at sight or sixty days after sight. The former are known as *short exchange,* and the latter as *long exchange.*

Days of grace are usually allowed on all foreign exchange.

The course of exchange on time bills is as much less than that on sight bills as the per cent. of interest for the time given plus the days of grace.

414. A *Documentary Bill of Exchange* is one accompanied with a Bill of Lading and Insurance Certificate, giving the title of the property represented by the Bill of Lading to the holder of the Bill of Exchange.

415. The following quotations of Foreign Exchange were taken from a newspaper.

STERLING EXCHANGE	SIXTY DAYS	SIGHT
Posted Rates	4.85½	4.89
Actual Rates	4.85	4.88½
Documentary Bills	4.82¾@4.83¼	4.85¾@4.86¼
FRENCH EXCHANGE	SIXTY DAYS	SIGHT
Posted Rates	5.18¾	5.16¼

Documentary Bills.............5.22½.............................5.20
GERMAN EXCHANGE.............SIXTY DAYS......................SIGHT
Posted Rates....................95¼.............................95¾
Documentary Bills.............94@94¼ .... .94⅝@94¾

NOTES.—1. Sterling Bills at 4.82¾@4.83¼ means that the lowest price paid on that day was $4.82¾ for one £, and the highest $4.83¼.

2. French Exchange at 5.18¾ means that the price was 5.18¾ francs for $1. Quotations are sometimes given, showing the cost of a franc, as, $.19⅕.

3. German Exchange at 94@94¼ means that the lowest price was $.94 for four marks; and the highest $.94¼. Quotations are sometimes given, showing the cost of a mark; as $.237.

1. What sum must I pay for a draft of £890 on London, exchange at $4.86¾?

2. James Smith remits to a customer a draft on Paris for 4056 francs, when exchange is 5.20. Find the cost.

3. Geo. Graham bought a draft of 2740 marks, to pay for a bill of goods. What did it cost at 96⅔?

4. A merchant sold to a bank a draft of £320.8s. 6d. at $4.82½. How much did he receive for it? (See footnote, page 283.)

5. A commission merchant remitted to his principal a draft of 1935 francs at 5.16. Find the net proceeds of the sale.

6. I received from my agent a draft of 1975½ marks at 94⅖. What was the amount of sale, commission being 5%?

7. An agent received a draft of £1245.2s. 3d. to invest in grain at 2% commission. How much can he invest, exchange at $4.84¾?

8. William Brown bought a bill of goods at a discount of 20%, and remitted for same a draft for 3209¾ francs at 5.12½. Find the invoice price of the goods.

9. C. H. Fuller received a draft for 8400 marks to invest in wheat at 85 cents per bu., at 5% commission. How many bushels did he buy, exchange being 93½?

10. My broker drew on me for £276 44/81 for stock bought at 110. What was the purchase price of the stock, if the brokerage was 2%, and exchange $4.86?   •

11. I remitted a draft on a Paris bank for 3072 francs at 5.22¼, in payment of a lot of silk bought at a discount of 20 and 12½%. Find the invoice price.

12. D. W. Graham remitted to his principal a draft for 8000 marks, bought at 96, for a lot of goods sold at 4% commission. Find the amount of his commission.

13. What is the face of a draft on a Liverpool bank, that cost $2848.09, exchange at $4.88?

14. What is the face of a draft on a Lyons bank, that cost $812, exchange at 5.16½ francs to $1?

15. The cost of a draft on Berlin was $156.75, when exchange was $.95 for 4 marks. Find face of the draft.

16. James Nolan paid $3439.95 for a draft on a bank of Dublin, exchange at $4.84½. What was the face of the draft?

17. An agent sold goods for a merchant of Berlin at 6⅖% commission. What is the face of the draft he must send in payment, exchange at $.93⅕; if the amount of the sale was $2000?

18. What is the face of a draft on London, that will pay for an invoice of $4000, bought at a discount of 25 and 14⅔%; when exchange is $4.86½?

19. I paid $368 for a draft on Paris, exchange at 5.17¾, to remit in payment for cloth sold at 8% commission. Find my commission and the face of the draft.

20. A merchant paid $720 for a draft on Frankfort, when exchange was 94, to remit in payment for cloth that was bought at 3 marks per yard. How many yards did he buy?

To reduce English money to the decimal of a pound ·

    (a) Write the number of pounds.
    (b) Place a decimal point after this.
    (c) Divide the number of shillings by 2 and write the result as tenths of a pound.
    (d) Multiply the number of pence by 4⅙ and write the result as thousandths of a pound.

BANKS AND BANKING

416. A *Bank* is an institution which deals in money or its representative. Banks are usually incorporated concerns, and are either *National* or *State* banks.

The chief business of a bank consists in:

1. Receiving deposits of money for safe keeping and convenience of customers.
2. Loaning money by discounting and collecting commercial paper.
3. Issuing bills or notes as a circulating medium.
4. Making collections.
5. Selling drafts on its correspondents.

Banks make no charge for keeping deposits and pay no interest on them except in rare cases, and then at a low rate. The privilege of loaning out a large proportion of the deposits is a source of profit to the bank, sufficient to compensate it for keeping the account.

NATIONAL BANKS

417. A *National Bank* is one which is organized under the National Banking Act of the United States.

According to the National Banking Act, Banking Associations may be formed of any number of persons not less than *five*.

No association can be organized with a capital less than $100,000, except in cities whose population does not exceed 6,000, where they may be formed, with the approval of the Secretary of the Treasury, with a capital of $50,000; also except that the Secretary may permit the organization of a bank with a capital of not less than $25,000 where the population does not exceed 3,000. In cities the population of which exceeds 50,000, the capital must not be less than $200,000, the stock being divided into shares of $100.

All national banks are subject to periodical visitation and examination by the National Bank Examiner, as the representative of the Secretary of the Treasury.

The stockholders of national banks are liable individually beyond their investment for the debts of the bank, to an amount equal to the stock which they hold.

National banks are not allowed to loan money on real estate security, and real estate purchased or mortgaged to secure a previous debt must be disposed of within five years.

418. *Circulation.* National banks issue circulating notes by depositing as security with the United States Treasurer an amount of Registered Bonds not less than one-fourth of the capital paid in. These bonds are held as security for the circulating notes, and in case the bank should fail the Government will redeem the notes. Banks are allowed to issue circulating notes to the full amount of the par value of the bonds deposited, but no bank can have a circulation greater than the amount of the capital stock paid in.

A bank desiring to reduce its circulating notes may deposit with the Treasurer legal tenders or specie in amounts not less than $9,000, and withdraw a proportionate amount of the bonds previously deposited. However, the amount of bonds on deposit shall not be reduced below $50,000.

419. *National Bank Notes* are redeemable by the banks issuing them or by the Treasurer of the United States.

Every national bank is required to keep on deposit in the Treasury of the United States, a sum equal to 5 per cent. of its circulation for the purpose of redeeming its bills, which is counted in as part of the Reserve.

420. A *Reserve Fund* equal to 25 per cent. of their deposits is required to be kept by national banks in the cities of New York, Boston, Philadelphia, Albany, Baltimore, Pittsburg, Washington, New Orleans, Louisville, St. Louis, Cleveland, Detroit, Chicago, Milwaukee and San Francisco, and 15 per cent. by all other national banks.

These are called *Reserve Cities,* and the excess above the requirements is called the *Surplus Reserve.*

421. A *Surplus Fund*, of the net earnings of the bank, is also required by law to be set aside, before the usual semi-annual dividends are declared, consisting of one-tenth of the net

profits for the preceding half year, until this fund amounts to
20 per cent. of the capital.

422. A *Tax* of one-half of 1 per cent. each half year is paid
to the United States by national banks on the *average amount* of
their circulation. But if the redemption bonds bear but 2% the
tax is one-fourth of 1% each half year.

The advantage to a bank under the National Bank Act is that it
receives interest upon the bonds deposited with the Treasurer and also
loans and uses its circulating notes, and thereby derives a profit from
them—thus making a double income upon the same amount of capital,
while paying a tax upon the circulation and being exempt from a tax on
the bonds.

A bank desiring to go into liquidation must deposit with the
Treasurer, six months before such liquidation, an amount of lawful
money equal to its outstanding circulation.

The law also requires that a sufficient amount, thus deposited for
the payment of circulating notes, must remain in the Treasury until the
last outstanding note shall have been presented. Hence, it will be seen
that the Government derives the benefit from notes which are lost or
destroyed by fire and water.

PROBLEMS

1. A bank having a paid up capital of $250000 desires to
issue circulating notes. What is the smallest amount of bonds
that it can deposit as security for such notes, and what amount
of notes will it receive?

2. It is desired to organize a national bank in a city whose
population is 3865. How many persons and what amount of cap-
ital are necessary? What amount of circulating notes may the
bank issue?

3. A bank deposits bonds to the amount of $480000 with the
Treasury. What will be the amount of its circulating medium?
What is the amount of its redemption fund?

4. A national bank having a capital of $400000, by injudi-
cious loans, impairs its capital $125000. What per cent. may each
stockholder be assessed to make good the loss? What must A
pay who owns 5 shares of stock?

5. A bank located in a reserve city has deposits amounting to
$850260. What is the amount of its reserve fund?

6. A national bank with a capital of $600000, and having a

surplus of less than 20% of its capital earns $22350 net profits during six months. What amount must be carried to the surplus fund and what amount will remain after declaring a 3% semi-annual dividend?

7. What is the redemption fund of a bank having a circulation of $425000? What amount of bonds were deposited to secure this circulation?

8. Find the semi-annual tax on a bank having an average circulation of $128650 if 3% bonds were deposited to secure circulation.

9. A national bank having a capital of $500000 and a surplus fund of $65000, earned $32650 during six months. What amount will be carried to the surplus fund? What amount will remain after declaring a semi-annual dividend of 3½%?

10. A bank desiring to reduce its circulation deposited with the Treasurer $51400 in specie. What was the market value of the bonds withdrawn at 108¾?

SAVINGS BANKS

423. A *Savings Bank* is an institution which receives deposits of money for safe keeping, and allows depositors interest thereon.

424. Interest is usually credited on deposits twice each year —July 1 and January 1, although some banks credit the interest quarterly. If the interest is not withdrawn it is allowed to draw interest, and thus the interest is compounded.

Usually no interest is allowed on parts of a dollar, and that is the plan which will be followed by the student. Banks do not usually allow interest on any sum which has not been in for the full term of the interest period. Some banks allow interest on money which has been on deposit during the entire quarter previous to interest day, while others allow interest on sums which have been deposited on or before the first of any month. No interest is allowed on amounts withdrawn before interest day.

Savings banks are subject to the laws of the state in which they are located. In some states they are restricted as to the size of deposits, rate of interest which they must allow, etc.

425. Since in nearly all savings banks no interest is allowed on money deposited or withdrawn during an interest term, there-

fore, *Interest is computed at the end of the interest term on the smallest balance on deposit at any time during the term.*

Note.—If it is desired to find the interest for several terms, consider the interest at the end of each quarter the same as a deposit on the first day of the next quarter.

In the following examples unless otherwise stated, deposits draw interest at 4% per annum, from the 1st of January, April, July and October. Interest days January 1 and July 1.

1. On September 10, A deposited in a savings bank $235. What amount of interest will be credited to his account on January 1?

Note—The deposit will not begin to draw interest until October 1, and the interest at 4% on $235 from October 1 to January 1 is $*.**.

2. A depositor is credited with the following deposits: January 1, 1904, $300; June 26, 1905, $230; August 18, 1905, $70. No withdrawals. What will be the credit of interest on January 1, 1906?

3. On July 1, 1902, a lady deposited in a savings bank $180; September 25, $60; February 10, 1903, $140; April 1, $300, and June 16, $280. What will be her credit in bank January 1, 1904, if no withdrawals have been made?

4. Mr. C deposits in a savings bank which allows interest at 4% on deposits from the first of each month and credits the interest up on January 1 and July 1. His deposits are as follows: January 1, 1905, $400; March 16, $130; June 28, $186; August 18, $260. What will be his balance January 1, 1906?

5. The following account is taken from the ledger of a savings bank, that pays interest at 4% quarterly. Interest commences at the first of each quarter, viz.: January 1, April 1, July 1 and October 1.

Date	With-drawals	Deposits	Balances
1905.			
Sept. 11........		230	230
Oct. 30........		70	300
Nov. 11........		200	500
1906.			
Jan. 1..........			500
Jan. 1..........		Int. 2.30	502.30
Jan. 9..........	177		325.30
Jan. 20.........	300		25.30
Feb. 23..		287	312.30
Mar. 15........	135		177.30
Apr. 1.........			177.30
Apr. 1.........		Int. .25	177.55
Apr. 8.........	75		102.55
Apr. 20........	25		77.55
May 16........		125	202.55
July 1.........			202.55
July 1.........		Int. .77	203.32

EXPLANATION.—The interest term being quarterly the interest is added to the balance on the first of each quarter. Since no interest is allowed on money withdrawn during the quarter, interest is computed only on the smallest balance in the quarter (Art. 425). The smallest balance in the first quarter is $230 and the interest on this for 3 mo. at 4% is $2.30. The smallest balance during the second quarter is $25.30, the interest on which is $.25. The smallest balance during the third quarter is $77.55, the interest on which is $.77, which added to the balance, gives the final balance as $203.32.

6. January 1, 1905, a clerk deposited in a savings bank $250; January 18, deposited $63; February 2, withdrew $40; February 18, deposited $25; March 12, deposited $48; March 18, withdrew $125; March 30, withdrew $175; April 18, deposited $100; April 25, deposited $36; May 10, deposited $10; June 15, withdrew $140. What was the balance to his credit July 1, 1905, interest 4% quarterly?

NOTE.—Arrange in the form of an account and extend the balances as in the previous problem.

7. A opened an account with a savings bank and deposited July 1, 1905, $200, withdrew July 20, $40; deposited August 8, $230; deposited August 20, $78; withdrew September 5, $100; deposited September 28, $185; deposited October 14, $137.50; withdrew October 27, $30; deposited November 13, $150; deposited November 18, $75; withdrew December 5, $60; withdrew December 13, $45. What was due him January 1, 1906, interest being 4% payable quarterly?

19

8. A deposit account upon the ledger of a savings bank stood as follows: July 1, 1905, balance $198.98; July 1, 1905, interest, $1.80; July 15, withdrawal, $75; September 10, deposits $3000; September 28, withdrawal, $125; October 3, withdrawal, $485; October 19, withdrawal, $500; December 9, deposit $162.32; December 14, withdrawal, $200; December 31, withdrawal, $25. What will be due the depositor January 1, 1906, interest quarterly at 4%?

9. The balance due a depositor at a savings bank January 1, 1905, was $450; February 3 he deposited $300; February 15, withdrew $85; March 16, deposited $627.50; March 24, withdrew $250; April 5, deposited $1000; April 18, withdrew $48.60; May 14, deposited $186.30; May 16, withdrew $45; June 4, deposited $75.30; June 12, withdrew $280; June 13, withdrew $43; July 17, deposited $78.40; July 24, withdrew $126.80; August 4, deposited $15; August 11, deposited $125; September 25, withdrew $250; September 30, withdrew $175; October 5, deposited $80; October 18, deposited $145; October 27, deposited $137.25; November 15, withdrew $160; December 11, withdrew $500; December 18, deposited $25; December 24, withdrew $850. What was the amount of his credit on January 1, 1906, interest at 4%, payable semi-annually?

10. What would be due a depositor at the end of the year, who had a balance of $1843 in bank on January 1, 1905; January 8, deposited $145.60; January 25, deposited $127.30; February 15, withdrew $180; February 26, withdrew $286; March 7, deposited $85; March 23, withdrew $1240; May 16, deposited $275; May 23, withdrew $143; June 12, deposited $1438; June 18, withdrew $745; July 7, withdrew $100; July 26, withdrew $40; July 29, deposited $200; August 14, withdrew $1350; August 25, deposited $180; September 14, deposited $460; September 28, withdrew $245; October 9, deposited $180; October 23, withdrew $500; October 27, deposited $1500; November 5, withdrew $640; November 17, deposited $340; November 20, deposited $60; December 18, deposited $250; December 31, withdrew $47.50. The

bank allows interest at 4% from the first of each month on all deposits remaining in during an entire month, credited quarterly.

Note.—Take the smallest balance in each month of the first quarter, add them together, and divide by three to get the average balance on which interest will be allowed. Take 1% of this. The result is the interest allowed for the quarter. Do the same for each quarter.

11. A's account stands credited January 1, 1905, $435; January 15, deposited $250; February 1, withdrew $145; March 10, withdrew $84; April 17, deposited $75; April 25, withdrew $300; May 22, deposited $250; June 18, deposited $60; July 28, deposited $340; July 31, withdrew $800; August 14, deposited $60; September 27, withdrew $25; October 20, deposited $38.50; November 5, withdrew $150; December 14, deposited $230. What will be the balance January 1, 1906, interest allowed at 4% on average monthly balances, and credited up semi-annually?

Note.—Take the smallest balance in each month of the first half year, add them together, and divide by six to get the average balance on which interest will be allowed. Take 2% of this. The result is the interest allowed for the half year. Do the same for the second half year.

12. A clerk had on deposit in a savings bank July 1, 1905, a balance of $625; July 20, deposited $40; August 3, withdrew $130; August 17, deposited $65; September 24, withdrew $28.50; October 5, withdrew $90; October 27, deposited $54.80; November 11, deposited $43; November 18, deposited $40; November 30, withdrew $166; December 12, deposited $48.50; December 17, withdrew $24.60. What will be his balance January 1, 1906, interest allowed at 4% on average monthly balances and credited up quarterly?

13. What will be the amount of John C. Duncan's balance at the end of the year, in a savings bank which allows 4% interest on average monthly balances, and credits up the interest at the end of each quarter, his account standing as follows: January 1, 1905, balance brought down $435; January 17, deposited $86; February 20, withdrew $135; March 13, withdrew $136.25; March 26, deposited $800; April 16, withdrew $475; May 10, withdrew $500; June 4, deposited $36.80; June 28, withdrew $75; July 11, deposited $600; August 14, withdrew $586; September 18, deposited $267; October 15, withdrew $56; November 15, deposited $180; December 4, withdrew $250; December 26, withdrew $65.

TAXES

426. A *Tax* is a sum assessed on persons or property to pay the expenses of a State, County or City or for other public purposes.

427. Taxes levied by the General Government are of two kinds: *Duties or Customs* and *Internal Revenue.*

428. Taxes levied by the State, County or City are of two kinds: *Property* and *Poll Tax.*

429. *Property Tax* is a Tax on property reckoned at a certain per cent. on the assessed value.

430. *Poll Tax* is a tax assessed on persons; in most of the states on all male citizens over 21 years of age.

431. An *Assessor* is a person elected to estimate the valuation of taxable property.

432. A *Collector* is an officer whose duty it is to receive and collect taxes.

In some states collectors are paid a certain per cent. for their services, and the amount levied must include the amount of money necessary to be raised plus the collector's fee.

In computations in taxes,

1. Assessed Valuation = Base.   2. Tax = Percentage.

ORAL PROBLEMS

1. What is A's tax on property assessed at \$1800, the tax levy being $1\frac{1}{4}\%$? $1\frac{1}{2}\%$? $\frac{1}{2}\%$? $\frac{1}{8}\%$?

2. What is a person's tax whose property is assessed at \$5000, when the rate of taxation is $2\frac{1}{2}\%$? $1\frac{1}{2}\%$? $1\frac{1}{4}\%$?

3. A's property is valued at \$6000, the assessed valuation is $\frac{2}{3}$. What is the tax, the rate of taxation being $1\frac{1}{2}\%$? $1\frac{1}{4}\%$? $1\frac{3}{4}\%$?

4. What is a person's tax on property valued at \$10000 assessed at $\frac{3}{4}$ valuation when the rate of taxation is 1% and who also pays poll tax for 4 persons at \$1.50 each?

5. A tax of \$36 is paid on property assessed at a rate of $\frac{3}{4}\%$. What is the assessed valuation?

6. A tax of $50 is paid on property assessed at $\frac{1}{2}\%$. What is the value of the property, the assessed valuation being at $\frac{3}{4}$ valuation?

1. A paid tax on $49200 at the rate of $.008\frac{1}{2}$ on the dollar, and paid 2 polls at $1.75 each. What amount of tax did he pay?

2. How much must I pay on property worth $9840, assessed for $\frac{2}{3}$ its value at $.011\frac{2}{5}$ on the dollar, and three polls at $2.10 each?

3. A village containing 220 taxable persons whose property was valued at $418500, was assessed for the purpose of building a school house, at $.013 on the dollar and $1.80 each for polls. What was the cost of the school house?

4. A tax of $.010\frac{4}{5}$ on the dollar and $1.35 for polls was assessed in Warren county for the purpose of building a court house. The value of property was $987430, and the number of taxable persons 1342. Allowing $2\frac{1}{2}\%$ for collecting, what amount was paid for the court house?

5. What amount of tax is paid on $43500 worth of property assessed for $\frac{4}{5}$ its value at $.012\frac{1}{4}$ on the dollar, and 34 polls at $1.20 each?

6. For the purpose of paving a street the property owners on the street were assessed on $214700 worth of property at $.009\frac{1}{4}$ on the dollar, and $.85 each on 94 polls. The charges for collecting were $4\frac{1}{2}\%$. What did the pavement cost?

7. A town assesses a tax of $.012\frac{1}{2}$ on the dollar, and $1.18 each on 115 polls. The personal property worth $86280 is assessed for $\frac{2}{3}$ its value, and real estate $65296 for $\frac{3}{4}$ its value. What was the amount of tax?

In practical tax computations a *Tax Table* is prepared by the use of which the labor of finding the tax is greatly reduced.

8. The assessed value of the property in a school district is $220488, and a tax of $1625 is voted. Construct a tax table similar to the one on the following page.

TAX TABLE—7.37 MILLS ON $1

	0	1	2	3	4	5	6	7	8	9
1	.07370	.08107	.08844	.09581	.10318	.11055	.11792	.12529	.13266	.14003
2	.14740	.15477	.16214	.16951	.17688	.18425	.19162	.19899	.20636	.21373
3	.22110	.22847	.23584	.24321	.25058	.25795	.26532	.27269	.28006	.28743
4	.29480	.30217	.30954	.31691	.32428	.33165	.33902	.34639	.35376	.36113
5	.36850	.37587	.38324	.39061	.39798	.40535	.41272	.42009	.42746	.43483
6	.44220	.44957	.45694	.46431	.47168	.47905	.48642	.49379	.50116	.50853
7	.51590	.52327	.53064	.53801	.54538	.55275	.56012	.56749	.57486	.58223
8	.58960	.59697	.60434	.61171	.61908	.62645	.63382	.64119	.64856	.65593
9	.66330	.67067	.67804	68541	.69278	.70015	.70752	.71489	.72226	.72963

From the table find the tax on A's property which is assessed $1380.

SOLUTION

Tax on $1300 = $9.581
Tax on   80 =   .589
Tax on $1380 = $10.17

EXPLANATION.—Look in the table opposite 1 in the left hand column and under 3 in fifth column and we find the tax on $13 is .09581. Removing the decimal point two places to the right which is equivalent to multiplying by 100 and we have the tax on $1300 = to $9.581. Then looking opposite 8 and under 0 and we find the tax on $80 to be .589. Adding these together we have the total tax.

9. According to the table what will be the amount of A. C. Dore's tax if his property is assessed $24365 and he pays for 3 polls at $1.80 each?

10. After May 1 a penalty of 1% per month is added to all unpaid taxes. S. D. Johnson's property is assessed at $42630 and he pays for 2 polls at $1.50 each. If he pays his tax August 3, what amount must he pay?

11. The amount of money to be raised by taxes in Ottawa is $212093.20. The taxable property is $11522400, and there are 3350 polls, each at $1.40. Find the rate of taxation. If the assessment is made on a ⅓ valuation, what would be the rate?

CUSTOMS OR DUTIES

433. *Customs or Duties* are taxes levied on imported goods for the support of the general government, and the protection of home industries.

434. *Ad Valorem Duty* is a tax of a certain per cent. on the cost of the goods in the country from which they were imported.

435. *Specific Duty* is a tax levied on goods without regard to value but estimated on weight or measure.

In some cases duties are *ad valorem*; on some articles they are *specific*; and some others they are both *ad valorem* and *specific*.

436. An *Invoice* on imported goods is an itemized list of goods shipped and their value in the country of origin.

All invoices on imported merchandise must be made out in the currency of the country of export and must be certified by the United States consul, vice consul or commercial agent in the country from which the goods are exported.

437. *Consul Fee* is a charge made by the consul but it is not a part of the dutiable value.

438. *Tare* is an allowance made for the weight of a box, bag, etc., containing the goods.

439. *Leakage* is an allowance made for waste of liquors in barrels.

440. *Breakage* is not allowed for loss of liquors in bottles, but shortage occurring before shipment will be considered.

441. *Gross Weight* is the weight before any deductions are made.

442. *Net Weight* is the weight after the deductions are made.

443. A *Tariff* is a list of goods, giving the rate of duty prescribed by law.

444. A *Custom House* is a government building or office where duties are assessed and collected and all other government business concerning that port is transacted.

Goods cannot be legally imported except through the custom house at a regular port of entry.

445. A *Port of Entry* is a town or city in which a custom house is located.

The chief port of entry in the United States is New York, but all of the principal cities are ports of entry.

446. *Smuggling* is *secretly* bringing goods into a country to avoid the payment of duties.

Smuggled goods when found are subject to seizure and the person or persons found guilty of such violations of the law, liable to a fine or imprisonment or both.

447. A *Bonded Warehouse* is a building used for the storage of imported merchandise until the duties shall have been paid.

Goods held for duties are said to be "in bond" and 10% extra duty is charged for each year that they remain in bond. If left for more than three years they are considered as abandoned to the government, and are advertised and sold at auction for payment of the duties.

448. *Internal Revenue* is the taxes levied on goods manufactured and sold in this country for the purpose of government support.

Internal revenue taxes are usually paid by affixing government stamps to the package containing the articles to be taxed, or by purchasing a government license.

In estimating ad valorem duties,

1. $Cost = Base.$ 2. $Duty = Percentage.$

Notes.—1. In estimating ad valorem duties all charges necessary to prepare goods for shipment must be added to net cost of goods to find the dutiable value.

2. In finding specific duties the *long ton* (2240 lbs.) is used. Allowances—Tare, Leakage, etc., are deducted before the duty is estimated.

1. What is the amount of duty on a shipment of 2500 lbs. invoiced at 3 shillings per pound, the rate of duty being 7c per pound and 5% ad valorem, 4% being allowed for tare?

Note.—One shilling = $24\frac{1}{3}$ cents.

2. L. M. Hawthorne received from London one case of merchandise, weighing 570 lbs. net. The invoice price was £370 10s; packing charges £10 8s. The ad valorem duty was 28%; the specific duty $12\frac{1}{2}$ cents per lb. What was the entire duty?

NOTE.—Add all charges to net cost to find dutiable value. £1 = $4.8665.

3. A manufacturer imported from England 35 bales of wool, weighing 440 lbs. each; tare 5%; cost 2½s. per lb.; specific duty 6 cents per lb. What was the duty?

NOTE.—The tare is deducted before finding cost and specific duty.

4. R. G. Waltz & Co. received an invoice of goods from France, amounting to 4250 francs on which there was 8% discount. The charges subject to duty were 213.9 francs. What was the duty at 40%?

NOTE.—1 franc = 19.3c.

5. H. J. Graham imported from Paris one case silk shawls. The first cost was 8340 francs; packing charges 215.05 francs; the net weight 842. What was the entire cost, at 60% ad valorem duty?

6. John W. Hauser & Co. received from Berlin an invoice of books amounting to 3284 marks. Case and packing cost 213.84 marks. What was the duty at 25%?

NOTE.—1 mark = 23.8c.

7. A merchant imported from Germany a box of merchandise invoiced at 2365 marks, on which there was a discount of 8%; charges 173.95 marks. Net weight was 920 lbs. What was the duty at 9 cents per lb. and 25% ad valorem?

8. An invoice of merchandise amounting to 3148 guilders was received at the Chicago Custom House. The charges for case and packing were 230.05 guilders. What was the duty at 36%; the par value of a guilder being 40.2 cents?

9. A merchant received from Brussels 1972 yds. of carpet 24 inches wide invoiced at 6 francs per yd. on which 4% discount was allowed. The charges were 394.77 francs. What was the entire cost with specific duty 44 cents per square yard and ad valorem duty 40%?

10. A hardware merchant imported from England one box of 50 doz. assorted knives invoiced at £270 6s. 9d., on which he was allowed a discount of 5 and 5%. The charges were £16 18s. 4.8d.;

net weight 740 lbs. What was the entire cost at 20 cents each, specific duty and 40% ad valorem?

11. A dry goods merchant imported from Manchester, England, 7 cases white muslins containing 1440 pieces, each piece being 27 yards long and 1¼ yards wide, the muslin was invoiced at 3½d. per yard, and the total charges were £32 17s. 6d. What was the duty on the invoice at 4½ cents per square yard and 20% ad valorem?

12. Invoice received by F. K. RACHLER & Co., St. Louis, Mo.

Marks	Nos.	Packages and Contents		Cost
F. K. R.	61	1 Case Carpet 1120 yds., 18 in. wide, @ 4 francs	***	
	62	1 Case Carpet 780 yds., 24 in. wide, @ 3⅛ francs	***	****
		Case and Packing		174.6
		Total cost		****
		Specific duty 22c pr. sq. yd.	*** **	
		Ad Valorem duty 40% on $	*** **	*** **
		Entire Cost		**** **

NOTE.—Find total cost in francs and reduce to U. S. money.

13. Invoice of one case of goods from B. A. WELSTEAD & Co., Liverpool, England, for R. T. RILEY & Co., Louisville, Ky.

Marks	Nos.	Packages and Contents	Duty	
			Ad.	Spec.
R. T. R.	428	720 yds. Velvet, 22 in. wide, @ £1 12s. yd.	25%	18c pr. sq.yd.
		1960 " Chiffon Lace @ 2s. 4d. yd.	60%	
		1120 " Carpet, 18 in. wide, @ 15s. yd.	40%	60c pr. sq.yd.
		2180 " Carpet, 26 in. wide, @ 10s. 6d. yd.	60%	60c pr. sq.yd.
		Net Cost		
		Duty on Velvet		
		" " Lace		
		" " Carpet		
		" " Carpet		
		Total Cost		***** **

EQUATION OF ACCOUNTS

449. An *Account* is a record of business transactions and may embrace either debits or credits or both.

450. *Equation of Accounts* is the process of finding the time when several debts due at different times, may be paid at one time without loss to either party, or if the account has two sides, when the *balance* or difference may be paid.

451. *Cash Balance* is the sum required to pay an account at any given date.

452. The *Term of Credit* is the time a debt has to run, as 10 days, 1 month, 90 days, etc.

All accounts bear legal interest after they become due.

Promissory notes, not containing an interest clause, bear legal interest after maturity.

453. The *Average Term of Credit* is the average of the several terms of credit.

454. The *Equated Time* is the date at which the payment of two or more debts may be made in one payment without loss to either debtor or creditor.

455. The *Focal Date* is any assumed date of settlement from which we reckon.

By assuming any date as a focal date, we find what the gain or loss of interest would be to the payer, if all the debts were paid by him on that date.

We then find the time the whole amount would produce this interest, and add the time thus found to, or subtract it from, the *focal date* to find the true date of settlement.

456. *To find the equated time when the account consists of only debits or credits.*

1. On January 1, 1905, I sold to P. J. Weaver, a house payable as follows: $200 in 3 months; $400 in 5 months; $500 in

12 months; $100 in 16 months. What is the average term of credit and the date when the whole amount should be paid?

SOLUTION—PRODUCT METHOD

Assume Jan. 1, 1905, as the date of settlement.

$$\$200 \times 3 = \$600.$$
$$\$400 \times 5 = \$2000.$$
$$\$500 \times 12 = \$6000.$$
$$\$100 \times 16 = \$1600.$$

$\$1200$ (due me) $\$10200.$

$$\$10200 \div \$1200 = 8\tfrac{1}{2} \text{ mo.}$$

Jan. $1 + 8\tfrac{1}{2}$ mo. = Sept. 16.

EXPLANATION.— If Weaver should pay the $200 on Jan. 1, 1905, he would pay it 3 mo. before it is due, and the interest on $200 for 3 mo. = the interest on $600 for 1 mo. due Weaver. The interest on $400 for 5 mo. = the interest on $2000 for 1 mo. due Weaver. The interest on $500 for 12 mo. equals the interest on $6000 for 1 mo. due Weaver. The interest on $100 for 16 mo. equals the interest on $1600 for 1 mo. due Weaver. Adding we find that Weaver owes me $1200 but I owe him the interest upon (or use of) $10200 for 1 mo. Now the interest on $10200 for 1 mo. is equal to the interest on $1200 for 8½ mo. Therefore Weaver may withhold the $1200 due me 8½ months or until September 16.

SOLUTION—INTEREST METHOD

Assume Jan. 1, 1905 as the date of settlement.

Int. on $200 for 3 mo. at 6% = $3.
Int. on $400 for 5 mo. at 6% = $10.
Int. on $500 for 12 mo. at 6% = $30.
Int. on $100 for 16 mo. at 6% = $8.

$1200 (due me) $51.

Int. on $1200 for 1 mo. at 6 % = $6.

$$\$51 \div \$6 = 8\tfrac{1}{2} \text{ mo.}$$

Jan. $1 + 8\tfrac{1}{2}$ mo. = Sept. 16.

EXPLANATION.—If Weaver had paid the several sums on January 1, 1905, I would have owed him $51 interest, hence he may keep the $1200 principal until the interest on it amounts to $51. Any rate of interest may be used, but it is most convenient to use 6%.

NOTES.—1. In finding the average term, fractions of a day of one-half or more are counted as one day; fractions less than one-half are rejected.

2. The product method is recommended because it involves less work and is more easily comprehended by the student, but accountants prefer the interest method. Both methods should be used until thoroughly understood.

2. On March 5, 1905, B bought the following bill from A: $240 on 10 days time, $300 on 20 days time, $450 on 30 days time, $600 on 60 days time. Find the date when the whole sum can be paid without loss to either party.

3. Jones bought a lot of merchandise for \$2100 from Brown of which \$400 was payable in 2 months; \$500, in 3 months; \$300, in 6 months; \$200, in 8 months; \$700, in 9 months. What is the average time of credit of the whole amount?

4. I owe \$150 due in 4 months; \$300 due in 6 months; \$600 due in 9 months; \$800 due in 12 months. What is the average time of credit?

5. Lyman bought a house on April 16, 1903, for \$2000, payable as follows; ⅕ cash, ¼ in 5 months, ⅜ in 8 months, the remainder in 10 months. What is the equated time for paying the whole, and the maturity of a note for the entire amount?

6. Graham sold the following merchandise on June 3, 1905: \$200 worth of prints on 30 days; \$360 worth of flannels on 2 months; \$420 worth of silks on 60 days; \$560 worth of cotton goods on 90 days. When can the whole amount be paid by the debtor without loss of interest?

7. A bought a farm on January 10, 1905, for \$7200, of which \$1200 was paid in cash, \$1000 was to be paid in 3 months; \$1200, in 6 months; \$1400, in 9 months; \$1300, in 12 months; the remainder, in 15 months. He gave his note for the amount due after making the cash payment. What should be the maturity of the note?

8. I bought the following goods from Fuller & Co. on July 1, 1905: \$180 on 10 days; \$210 on 30 days; \$340 on 60 days; \$620 on 90 days; \$750 on 4 months; \$200 on 6 months. Find the maturity of my note given, to pay the entire amount.

9. Find the equated time and date of settlement of the following, sold on May 21, 1905: \$160 on 15 days; \$360 on 1 month; \$190 on 40 days; \$425 on 2 months; \$230 on 90 days; \$490 with no term of credit; \$85 on 4 months; \$310 on 5 months; \$660 on 5 days; \$900 on 10 days; \$515 on 20 days; \$740 on 25 days.

10. March 20, I bought a horse for \$175, on a credit of 4 months; May 5, a harness for \$35, on 3 months; and June 15, a carriage for \$225, on 6 months. Find the equated time for the payment of these debts.

SOLUTION

	DUE.	ITEMS.	DAYS.	PROD.
March 20 + 4 mo. = July 20		$175	. . . .	. . . .
May 5 + 3 mo. = Aug. 5		35	16	560
June 15 + 6 mo. = Dec. 15		225	148	33300
		$435		$33860

$33860 ÷ $435 = 78 = 78 da. average term of credit.
July 20 + 78 da. = Oct. 6, equated time.

Find the equated time for the settlement of the following bills:

11. Bill No. 1. Terms cash. | *12.* Bill No. 2. Terms 30 days.

1905			1905		
Feb. 2,	Mdse.	$425.	June 2,	Mdse.	$247.20.
March 10,	"	$320.	July 14,	"	$165.
May 6,	"	$195.	July 30,	"	$280.
June 30,	"	$1120.	August 4,	"	$760.

13. Bill No. 3

William Hammond,

To P. D. Armour & Co. Dr.

1905				
Apr.	2	40 bbl. *Beef*	30 da. $13.50	
May	14	60 " *Mess Pork*	60 da. $10.25	
June	8	25 " *Short Ribs*	90 da. $ 2.75	

14. Bill No. 4. | **15.** Bill No. 5.

1905 | 1905

Oct. 22, Mdse. 1 mo., $116.20. | April 6, Mdse. 10 da., $236.10.
Dec. 14, "   2 mo., $275. | May 2,   "   20 da., $71.15.
1906 | May 23,   "   15 da., $329.
Jan. 18, "   3 mo., $79.25. | June 7,   "   30 da., $143.50.
March 11, "   1 mo., $367.40. | July 2,   "   60 da., $420.
May 4,   "   2 mo., $67.85. |

	16. Bill No. 6.		*17.* Bill No. 7.
1905		1904	
Feb. 4,	Mdse. 30 da., \$72.45.	Oct. 30,	Mdse. 6 mo., \$250.
March 12,	" 10 da., \$16.90.	1905	
April 23,	" (cash) \$41.20.	April 27,	" 10 da., \$365.
May 1,	" 20 da., \$62.	August 1,	" 3 mo., \$270.
June 6,	" 15 da.; \$98.10.	1906	
July 12,	" 30 da., \$26.35.	Jan. 21,	" 60 da., \$124.
		May 1,	" 30 da., \$417.

18. Find the equated time for settlement of the following:

STATEMENT OF ACCOUNT

Boston, Sept. 1, 1905.

Charles D. Rogers,

In account with French, Potter & Wilson.

1905					
January	10	To Mdse.	30 da.	162	30
April	19	" "	60 da.	321	45
June	24	" "	Cash	99	
August	10	" "	4 mo.	172	
				754	75

457. *To find the equated time for the payment of the balance of an account having both debits and credits.*

1. Find the equated time for the payment of the balance of the following account.

Dr.				A. R. Harmon.				Cr.
1905				1905				
January	1	Mdse.	400	March	4	Cash	200	
Feb.	6	"	720	"	25	"	350	
April	2	"	500					

When an account has both debit and credit sides as the above, the equated time for the payment of the balance may be found by either the Product Method or the Interest Method. The above problem is solved by both of these methods in order that the stu-

dent may familiarize himself with them. Accountants usually prefer the interest method, as it appears more business-like.

SOLUTION—PRODUCT METHOD

FOCAL DATE, JANUARY 1, 1905

DUE.	ITEMS.	TIMES.	PRODUCT.	DUE.	ITEMS.	TIMES.	PRODUCT.
Jan. 1,	$400	0	000	March 4,	$200	62	$12400
Feb. 6,	$720	36	$25920	March 25,	$350	83	$29050
Apr. 2,	$500	91	$45500		$550		$41450
	$1620		$71420				
	550		41450	Subtracting smaller side.			
	$1070		$29970				

$29970 ÷ $1070 = 28 da. = average term of credit.

Jan. 1, 1905 + 28 da. = Jan. 29, 1905, equated time of pay-ment.

EXPLANATION.—Assuming Jan. 1, 1905, as the focal date we find the products upon the Dr. and Cr. sides as in previous problems. Then sub-tracting the credit from the debit side we find the balance of the items to be $1070 and the balance of the products to be $29970 both in favor of the debit side. Therefore the balance of the account $1070 is entitled to a credit long enough to equal $29970 for one day, which we find by dividing to be 28 days. This added to the focal date gives Jan. 29, 1905.

Should the balance of the items be on one side and the balance of the products on the other side of the account, if the earliest date is taken as a focal date, the balance of the account must suffer a *discount*, or be due *prior* to the focal date, and hence we count back of the focal date to find the equated time.

SOLUTION—INTEREST METHOD

LOCAL DATE, APRIL 2, 1905. INTEREST 6%.

DUE.	ITEMS.	TIMES.	INTEREST.	DUE.	ITEMS.	TIMES.	INTEREST.
Jan. 1	$400	91 da.	$6.07	Mar. 4,	$200	29 da.	.97
Feb. 6,	$720	55 da.	$6.60	Mar. 25,	$350	8 da.	.47
Apr. 2.	$500	0	0		$550		$1.44
	$1620		$12.67				
	$550		1.44	Smaller side subtracted.			
	$1070		$11.23	Int. on $1070 for 1 da. = $.17⅚.			

$11.23 ÷ $.17⅚ = 63 da. average term of credit.

April 2—63 da. = Jan. 29, equated time of payment.

NOTES.—1. Any date may be taken as a focal date, but it simplifies the reasoning to assume either the earliest or the latest date, the result being the same in both cases.

2. In an account that contains both debits and credits, the items on the debit of the ledger of one of the parties are the same as those on the credit of the ledger of the other party; hence, an account equated by both parties must show the same result.

2. Find the average time for the payment of the balance of the following account:

Dr.						A. E. BAKER.				Cr.	
1905						1905					
May	12	Mdse.	370			June	4	Cash		220	
May	31	"	192	80		July	2	"		175	80
June	14	"	126			July	26	"		150	
July	6	"	217								

3. When is the balance of the following account due?

Dr.					J. F. SARLEY.				Cr.	
1905					1905					
Jan.	17	Mdse., 30 days	300		Feb.	1	Cash		100	
Feb.	27	" 10 "	240		Mch.	4	Note, 15 da.		150	
Mch.	12	" 20 "	450		April	6	Cash		350	
April	1	" 30 "	600		May	10	"		120	

NOTE.—Find the maturity of each item and use the due dates in equating or add the special credit to time from regular date.

4. Find the date of a note to settle the balance of the follow-ing accounts:

Dr.						F. W. C. HOLTKAMP.					Cr.	
1905						1905						
May	1	Mdse., 5 days	217	80		June	4	Note, 20 da.		150		
"	30	" 15 "	192			July	1	Cash		68	30	
June	14	" 30 "	62	30		"	15	"		209	70	
"	27	" 10 "	377	90								

20

5. Average the following account:

Dr.						Cr.			
1905						1906			
Nov.	20	Mdse., 3 *months*	560			Mch.	5	Draft, 15 *da.*	250
Dec.	27	" 3 "	178			April	3	Note, 1 *mo.*	130
1906						May	1	Cash	75
Jan.	31	" 60 *days*	93	45		"	15	Mdse., 10 *da.*	180
Mch.	2	" 30 "	230	55					
April	17	"	120						

6. When is the balance of the following account due?

Dr.						Cr.			
1905						1905			
Jan.	6	Mdse., 30 *days*	272			Mch.	2	Note, 20 *da.*	172
"	30	" 60 "	536	15		April	1	Ck. dated	
Feb.	20	" 10 "	73					April 15	300
Mch.	18	" 15 "	121	60		May	24	Cash	150
April	12	" 10 "	83	25		"	31	"	100

7. Average the following account:

Dr.						Cr.				
1905						1906				
Oct.	1	Mdse., 2 *months*	190			Jan.	1	Cash	130	
Dec.	4	" 30 *days*	274			Mch.	19	Acceptance		
1906								10 *days*	228	
Jan.	11	" 20 "	311	40		"	24	Cash	173	
Feb.	21	" 20 "	86	20		April	1	"	217	95
April	1	"	217	95						

8. What is the balance of the following account, and when will it begin to draw interest?

Dr.						Cr.				
1905						1905				
April	1	Cash	125			Jan.	21	Mdse., 60 *da.*	166	60
May	4	Note, 10 *days*	200			Feb.	28	" 90 "	219	28
"	1	Sight draft	100			April	20	" 20 "	52	80
July	1	Cash	250			June	30	" 10 "	356	
Aug.	15	"	199	63		July	14	" 15 "	411	35
						"	30	" $380,		
								4% off	***	**
						Aug.	15	" $210,		
								3 & 2% off	***	**

9. When must a note be dated and commence drawing interest if given in settlement of the following account?

Dr.			W. W. COFFIN.							Cr.	
1905						1905					
July	1	Mdse., 90 *days*	208	60		Dec.	1	Cash		360	
Oct.	30	" $420,				1906					
		4% off	***	**		Feb.	19	Note, 30 *da.*		135	
1906						April	1	Mdse., $220			
Jan.	1	" 20 *days*	114	50				6% off		***	
Mch.	3	" 10 "	374	90		May	5	Cash		123	70
May	1	" $160									
		5 & 5% off	***	**							

10. Find the average date of payment in the following:

Dr.			D. C. ROBERTS.						Cr.	
1903						1904				
Aug.	30	Mdse., 4 *months*	210			Jan.	1	Mdse., $120,	***	**
Nov.	3	" 3 "	147	20				3% off		
1904						July	1	Note, 3 *mo.*	230	
May	4	" 60 *days*	379	35		Dec.	1	Cash	175	
Aug.	6	" 60 "	430	25		1905				
Dec.	12	" 30 "	53	15		Jan.	30	Mdse., 30 *da.*	291	40
1905										
Jan.	1	" $270,								
		6 & 2% off	***	**						

11. Find the balance due on the following account, July 10, 1905, interest allowed at 6%.

Dr.				L. H. YOUNG.				Cr.	
1905					1905				
Jan.	4	Mdse., 10 *days*	400		Mch.	21	Cash	200	
Feb.	16	" 20 "	360		April	30	Note, 15 *da.*	150	
April	5	" 30 "	500		June	3	Cash	120	

12. If the following account is settled January 1, 1907, money being worth 7%, what amount must be paid?

Dr.		B. E. IRWIN & Co.					Cr.	
1905					**1905**			
Nov.	10	Mdse., 60 *days*	320		April	4	Cash	450	
Dec.	23	" 90 "	185		May	16	Draft, 60 *da.*	95	
1906					**1906**				
Mch.	12	" 30 "	236	90	June	3	Note, 1 *mo.*	120	
June	4	" 10 "	468	60	July	20	Cash	186	50
July	3	" 15 "	241	50					

458. *To find the date of payment of the net proceeds of a consignment.*

The sales constitute the credit side of the account. The expenses of the consignment (freight, storage, commission, etc.), and the money advanced before the account is closed, constitute the debit side of the account.

Find the average due date of the sales, and take this date as the due date of the commission. Find the due date of settlement the same as in previous problems.

1. When are the net proceeds of the following account sales due?

Account Sales of Pork.   Nashville, Tenn., Sept. 1, 1905.
Sold for account of Swift & Co., Chicago, Ill.

1905							
July	3	25 bbls. Mess Pork @ $12.80, 30 days.	***	**			
"	23	45 " Mess Pork @ $12.60 cash.	***	**			
Aug.	6	40 " Prime Pork @ $13, 20 days.	***	**			
"	17	30 " Prime Pork @ $12.85, 10 days.	***	**	****	**
		CHARGES					
July	1	Freight	71	40			
"	1	Cash advanced	250				
		Commission (due——) 4%	***	**	****	**
		Net proceeds (due——)			****	**

2. When will the net proceeds of the following account sales be due?

Account sales of flour sold for account of Geo. F. Snyder & Co., Minneapolis, by Davis & Co.

1905							
May	6	110 bbls. XX Flour @ $5.90, 10 days.	***	**		
"	30	90 " XX Flour @ $6, 5% off	***	**		
June	16	76 " XXX Flour @ $6.05, 20 days.	***.*	**		
"	30	125 " XXX Flour @ $6.10 cash.	***	**	****	**
		CHARGES				
May	2	Freight	86	12		
"	6	Accepted Snyder's draft, 15 days	400			
"	25	Cooperage	12			
June	30	Storage	23	80		
		Commission (due——) 3½ %	**	**		
		Net proceeds (due——)			****	**

After having ascertained the date at which the Net Proceeds of a consignment is due, to find the cash balance at any later date, add the interest to the Net Proceeds for the intervening time.

3. Find the date of settlement of the net proceeds, and the cash balance on September 1, 1905—7%.

Account sales of produce by John Mason, for account of J. B. Hayes, Detroit, Mich.

1905							
March	12	300 doz. Eggs @ 15 cts., 30 days	**	**		
"	16	700 lbs. Butter @ 21½ cts., 10 days	***	**		
April	23	210 doz. Eggs @ 14½ cts., cash	**	**		
May	4	200 lbs. Butter @ 22½ cts., 2% off	**	**		
"	6	290 doz. Eggs @ 15 cts., 10 days	**	**	****	**
		CHARGES				
March	3	Freight	90	60		
"	3	Cartage	7	90		
"	5	Cash advanced	150			
May	6	Storage from March 3	31	50		
		Commission (due ——) 4%	***	**	****	**
		Net proceeds (due ——)			****	

4. Find the average due date of sales; the true date of settlement of the proceeds and the cash balance on August 10, 1905 —6%.

Sales of A. B. Wilson & Co., for account of S. R. Lockwood & Co., Springfield, Ill.

1905						
Feb.	14	105 bbls. Potatoes @ $1.40, 10 days	***	**		
March	2	80 " Apples @ $2.80, 3% off	***	**		
"	30	120 " Apples @ $2.75, 20 days	***	**		
April	3	75 " Potatoes @ $1.35, 30 days	***	**		
"	16	20 " Potatoes @ $1.45, cash	***	**	****	**
		CHARGES				
Feb.	10	Freight	64	28		
"	10	Drayage	11	50		
"	15	Accepted their draft at 10 days	200			
"	19	Cooperage	6	20		
April	16	Storage from Feb. 10	15			
		Commission (due——) $4\frac{1}{2}\%$	***	**	****	**
		Net proceeds (due ———)			****	**

CASH BALANCE

459. *Cash Balance* is the amount of money which will settle an account on a given date. Cash balance is the difference between the two sides of an account, with the interest added to all past, due items.

In settling mercantile accounts interest is not always reckoned. This is regulated by previous agreement and also by custom. When interest is charged it is calculated from the time the account is due.

The cash balance of an account may be found by either the product, or interest method, but the latter is preferable.

1. Find the cash balance July 3, 1905, on the following account, interest at 6%.

Williams & Brown in account with

| Dr. | | | | J. R. Wood | | | | | Cr. |

1905						1905					
Jan.	24	Mdse 20 da.	168	50		Apr.	2	Cash		150	
Mar.	1	Mdse 15 da.	79	20		May	6	Note 13 da.	270	50
May	4	Mdse 10 da.	364	80		"	6	Cash		63	50
"	23	Mdse	204	50		June	2	Cash		100	

DUE.	ITEMS.	DAYS.	INTEREST.		DUE.	ITEMS.	DAYS.	INTEREST.
Feb. 13,	$168.50	140	$3.93		Apr. 2,	$150.00	92	$2.30
Mar. 16,	79.20	109	1.44		May 19,	270.50	45	2.03
May 14,	364.80	50	3.04		May 6,	63.50	58	.61
May 23,	204.50	41	1.39		June 2,	100.00	31	.52
	$817.00		$9.80			$584.00		$5.46
	584.00		5.46					
	$233.00	+	$4.34	=	$237.34			

EXPLANATION.—If J. R. Wood had paid nothing before July 3, he would owe the items on the Dr. side of the account and also the interest on them to July 3 amounting to $9.80; but as he paid some amounts before that date he is entitled to credit for the amount paid and also the interest upon them from the date of payment until July 3, amounting to $5.46. This interest deducted from $9.80 leaves $4.34 the net amount of interest added to the balance of the account gives the total due, or cash balance due on July 3, 1905, $237.34.

NOTES.—1. When the balance of interest is on the same side of the account as the balance of items, it is added to the balance of the items; when it is on the opposite side it is subtracted from the balance of the items.

2. In computing interest regard fractional parts of a dollar less than half as nothing, and equal to or greater than half as one dollar. But in adding these items the exact cents must be taken.

2. Find the cash balance on October 30, 1905, at 6% interest.

Dr.				E. T. NICHOLS.			*Cr.*	
1905					1905			
Mar.	5	Mdse.	146	30	May	1	Cash	100	
April	3	" 10 *days*	561	40	June	4	Note, 30 *da*	165	50
May	17	" 20 "	328	80	"	30	Check	75	
June	4	" 15 "	196	50	July	5	Cash	290	50
July	10	" $600							
		3 & 5% off	***	**					

3. Find the cash balance on September 1, 1906, at 5% interest.

Dr.				E. J. COLLINS.			*Cr.*	
1905					1906			
Aug.	30	Mdse. 90 *days*	278		Jan.	1	Note, $250 with in-		
Dec.	16	" 30 "	123	25			terest for 8 mo.		
1906							10 da., at 8 per	***	**
Feb.	3	" $960			Mar.	12	cent. Note, 2 *mo.*	540	
		5 & 5% off	***	**	April	2	Mdse. $140,		
Mar.	21	" $820,					2% off	***	**
		3 & 4% off	***	**	May	10	" $310,		
April	6	" 20 *days*	378	15			5 & 6% off	***	**
May	1	" $260, 4% off	***	**	"	20	Cash	180	

4. Find the cash balance on January 1, 1906, at 6% interest.

Dr.				I. K. JAMES.			*Cr.*	
1905					1904			
Jan.	13	Note, 60 *days*	225		June	4	Mdse., 3 *mo.*	196	30
"	28	Draft, 33 "	172	15	Sept.	10	" 2 "	211	40
May	1	Check	86	40	1905				
"	30	Cash	123	45	Jan.	1	" $440,		
June	10	Note, 13 "	75				2 & 4% off	***	**
"	30	Cash	100		Mar.	1	Mdse., $175,		
							5% off	***	**
					June	1	" 30 *da.*	280	
					"	26	" 10 "	192	80

PARTNERSHIP

460. A *Partnership* is an association of persons who join their capital, labor and skill—for the purpose of conducting some business, and who agree to divide the profits and bear the losses in certain proportions.

The business association is called a *Firm or House.*

461. *Partners* are the persons forming the association. They are *active* or *silent, general* or *special.*

1. An *active partner* is one who takes an active part in the management of the business.

2. A *silent partner* is one who furnishes capital, and shares in the profits and losses, but takes no active part in the management of the business.

3. A *general partner* is one who is responsible for the debts of the company to the amount of his entire property.

4. A *special partner* is one whose responsibility is limited to a certain amount specified in the *written articles of partnership.*

462. The *Capital* is the money or other property invested in the business.

463. *Resources,* sometimes called *Assets,* of a firm are its entire property including all debts due the firm.

464. *Liabilities* of a firm are its debts.

465. *Net Capital* of a firm is the excess of its resources over its liabilities.

466. *Net Insolvency* of a firm is the excess of its liabilities over its resources.

467. *Net Investment* of a partner is the amount of the capital of the firm which he has invested less the amount he may have withdrawn from the business.

468. *Net Gain* of a firm is the excess of total gains over total losses.

469. *Net Loss* of a firm is the excess of total losses over total gains.

The *Gain* is found by subtracting the investment from the net worth at closing. The loss is found by subtracting the net worth at closing from the investment.

Gains and losses are divided between the partners according to agreement, but in the absence of any express agreement, it is understood that the partners are to share equally in gains or losses.

Partnerships are *General,* and *Special* or *Limited.*

470. A *General Partnership* is one in which each partner is liable for the debts of the firm to the full extent of, not only his interest in the business, but his private property also.

471. A *Special* or *Limited Partnership* is one having one or more general partners and one or more special partners. Each special partner is liable for the debts of the firm only to the extent of his investment, and his private property cannot be taken to pay firm debts.

The laws relative to special or limited partnerships in most states require:

1. That written articles of copartnership shall be drawn, signed by all the partners, specifying the general and special partners, and the amount invested by each, which articles must be recorded in the public records of the county.

2. There must be at least one general partner, who shall manage the business and who shall be liable for the debts of the firm the same as in a general partnership.

3. Special partners shall take no active part in the management of the business.

4. The investment of each special partner must be fully paid in.

An omission of any of these conditions makes the partnership gen-

eral and all of the partners equally liable for debts the same as in a general partnership.

472. *The investment and the resources and liabilities at closing being given to find the gain or loss.*

1. A firm invested cash $2300; merchandise $1180; other persons' notes $1500; accrued interest $20. At closing the resources were cash $3900; merchandise $362; notes due $1698; accrued interest $49.20; personal accounts due $991.80. Find the gain.

NOTE.—From the total resources at closing subtract the total investment.

2. A and B formed a partnership for a year. A invested cash $1600; notes $380; Lyman's account $120. B invested merchandise $1280; notes $415; horse and wagon, valued $205. The firm had at the close of the year cash $3200; merchandise $312.40; notes due $480.20; personal accounts $1049.90. How much did they gain?

3. Sanders and Reed formed a partnership and invested as follows: Cash $3300; dry goods invoiced at $600 with a discount of 10 and 5%; Byrne's note of $720, that had been on interest 4 months at 9%; personal accounts due $629.10; fixtures $216.50. They had at closing $4217.20 cash in the bank, $370 cash in the safe; $490 worth of fixtures; $1200 worth of merchandise. Did they gain or lose and how much?

4. Smiley, Richards and Bloomer formed a partnership for two years. Smiley invested cash $1000; real estate $1800. Richards invested a stock of groceries $2000 with 3% and 5% off; cash $1000. Bloomer invested cash $1250; office fixtures $160; horse and wagon, $270; Brown's note of $450, with accrued interest for 5 months 10 days at 10%. The firm sold all its property at the end of two years and had $10699.28 cash. Find the gain.

5. A invested $1250 cash; store valued at $2150; personal accounts $382.50. He owed a note of $320 which the firm assumed. B invested $3180 cash; office safe valued at $145. He owed personal accounts $653.30 which the firm assumed. C in-

vested his stock of clothing, invoiced at $2700 on which he al-
lowed a discount of 4%. The resources at closing were cash
$6394.25; merchandise $1746.35; store $2000; office safe $130;
Reeve's note of $980 which had been on interest for 114 days at
9%. Was there a gain or loss and how much? What was each
partner's portion of the gain or loss A sharing $\frac{5}{11}$, B $\frac{4}{11}$ and C $\frac{2}{11}$?

Note.—Subtract the debts of the partners, which were assumed by
the firm from their investment to find the net worth at the beginning.

6. Smails, Dorsey, Adams and Piper formed a partnership to
share the gains and losses equally, and invested as follows:
Smails invested cash $3000; 10 shares bank stock worth $126 per
share. Dorsey invested his stock of boots and shoes valued at
$4000. Adams invested cash $1900; a real estate mortgage of
$2000 with accrued interest for 6 months and 20 days at 8%.
Piper invested his store and lot valued at $3750. During the
time of partnership Smails withdrew cash $300 and merchandise
$92.40. Adams withdrew cash $217.20. Dorsey withdrew mer-
chandise $37.50. Piper withdrew cash $226. The property at
closing was cash $17294.10; outstanding notes $2432.15; per-
sonal accounts $234.90. Did the firm gain or lose and how much?
What was each partner's share of the gain or loss?

Note.—The withdrawals of the partners must be added to the re-
sources at closing to find total amount as if nothing had been drawn.

473. *The investment, the resources and liabilities at closing
and the proportion in which the partners share the gains or losses
being given, to find each partner's interest in the concern at clos-
ing.*

1. A and B are partners. A is to share $\frac{2}{5}$ of the gain or loss,
and B $\frac{3}{5}$. At the close of business the following is shown to be
the condition of their affairs, viz.: Cash on hand $2680. Bills
receivable on hand $3620. Five shares Bank stock valued at $520.
House and lot valued at $6000. Wilson & Co. owe on account
$1800. The firm owe on notes outstanding $2840. They owe C.
W. Lane on account $890. A invested $4610. B invested $4860.
What is A's interest in the concern? What is B's interest in the
concern?

SOLUTION

RESOURCES		LIABILITIES	
Cash on hand	$2680	Notes unpaid........	$2840
Bills Receivable	3620	Due C. W. Lane	890
Bank Stock..........	520	A invested..........	4610
House and Lot.......	6000	B invested..........	4860
Wilson Co. owe......	1800		
	$14620		$13200
	13200	A invested..........	4610
		A ⅖ net gain	568
Net gain...........	$1420	A present interest in	
5)1420 net gain.		concern...........	$5178
284 ⅕ net gain.		B invested..........	4860
3		B ⅗ net gain........	852
$852 B's ⅗ net gain.		B present interest in	
568 A's ⅖ net gain.		concern...........	$5712

2. C, D and E formed a copartnership, each to share ⅓ of the gains and losses. At the close of the year the resources and liabilities were as follows: Cash in bank $3600. Stock of goods in store $10680. Bills receivable on hand $5820. Mining stock valued at $8730. Stock in Third National Bank $2850. Store building and lot valued at $28000. Account due from Lyons & Co. $865.30. W. C. Anderson owes the firm $1630. Wm. D. Barr owes the firm $178.50. The firm owe on their notes outstanding $4380. They owe Davis & Morse $1325. C invested $12650. D invested $12400. E invested $12250. What is each partner's interest in the concern at closing?

3. Jones, Brown and Smith entered into a copartnership, they to share gains and losses as follows: Jones ⅖, Brown ⅖ and Smith ⅕. After conducting business one year the following are the resources and liabilities: Cash on hand $3625. Mill and other real estate $8342. Bills receivable $1230. G. W. Samuels owes the firm $375. A. W. Dakin owes the firm $637. L. M. Painter owes the firm $1632. Stock in Globe National Bank $2430. Brown has withdrawn during the year $350. Smith has withdrawn $180. The firm owe on notes outstanding $5720. They owe H.

B. Conant $1300. Jones invested $3600. Brown invested $3000. Smith invested $2800. What is each partner's interest at closing?

4. F, G, H and I are partners. They share the gains and losses as follows: F and G each $\frac{3}{12}$, H $\frac{4}{12}$ and I $\frac{2}{12}$. After doing business one year they find the following resources and liabilities: Cash in bank $4230. Cash in safe $320. Merchandise in store $12840. Goods shipped away on consignments $1640. Real estate $6400. Horses and wagons $1000. Wheat and corn $930. Lumber $1730. Accounts receivable $2340. F has withdrawn from the business $350. H has withdrawn $260. The liabilities of the firm are notes outstanding $3860. Due Marshall Field & Co. $820. Due John W. Norris & Co. $135.40. Due N. K. Fairbank $216.30. F invested $5834. G invested $6243. H invested $6000. I invested $5635. What is each partner's interest in the concern at closing?

5. There are four partners in a concern, O, P, Q and R. Each partner to share $\frac{1}{4}$ of the gains or losses. At dissolution there is: Cash on hand $6820. Bills receivable $8922. C. B. & Q. R. R. stock $4500. Deposit in National Bank Commerce $3680. O has drawn from the concern $860. P has drawn $575. Q has drawn $630. R has drawn $452. The liabilities are: Notes and Acceptances outstanding $3680. Balance in favor of Smith & Co. $1264, in favor of Collins, Downing & Co. $860, Geo. Warner $575. O invested $5590. P invested $5322. Q invested $5540. R invested $5228. What has been the net gain or loss? What is each partner's interest in the business?

474. *The investment and the gains and losses being given, to find the capital at closing.*

1. A and B are partners, sharing the gains and losses equally. A invested $2865. B invested $3000. The gain during the year was $1860 on Merchandise. $76.20 Interest. The loss was $216.15 Expenses. $2.20 Exchange. $14.13 Discount on notes paid before they were due. Find the net gain, and the net capital at closing, also each partner's interest at closing.

SOLUTION

	A					B		
Balance	$3701.86	Investment Gain	$2865 836.86		Balance	$3836.86	Investment Gain	$3000 836.86

Profit and Loss

Expense............$246.15	Mdse..............$1860
Exchange 2.20	Interest............ 76.20
Discount 14.13	
A's gain 836.86	
B's gain 836.86	
$1936.20	$1936.20

A's interest at closing...............$3701.86
B's interest at closing.............. 3836.86
Firm's capital at closing............$7538.72

2. Parker, Hammond and Siders formed a partnership for one year, sharing gains and losses equally. Parker invested cash $3600, and withdrew during the year $230. Hammond invested cash $1200; Merchandise $1480; Notes $365; Accounts due him $240. He withdrew during the year $176. Siders invested real estate $1975; Cash $640; Potter's note of $220 that had been on interest at 7% for 1 year and 6 months. They gained $2468.45 on Merchandise and $29 interest on notes. The loss was $290.50 expenses for running the store. What was the interest of each partner, and the capital of the firm, at closing?

3. Stewart, Nevins and Barnard are partners in business. Stewart is to share $\frac{2}{5}$ of the gains or losses, Nevins $\frac{2}{5}$ and Barnard $\frac{1}{5}$. Stewart invested Dry Goods valued at $2250 with 2 and 10% off; White's Note of $1248, due in 6 months, on which he allows true discount at 8%. Nevins invested Cash $2500; Personal Accounts $426.80. Barnard invested Store and Lot worth $3250. During the term of partnership Stewart withdrew Merchandise $68.20 and invested $750 Cash. Nevins made an additional investment of $1000 Cash and withdrew $110 worth of Merchandise. Barnard withdrew $420 Cash. The gains were $1968 on Merchandise, $220 Rent for part of store, $23.10 Interest. The losses were $360 Expenses, $33.95 on Personal Accounts. What

was the net worth of each partner, and the firm's net capital, at closing?

4. A, B, C and D formed a copartnership for one year. A is to share ¼ of the profits or losses, B ⅜, C ¼ and D the remainder. On January 1, A invested cash $1200; Merchandise $280; Notes $760; Personal Accounts due him $316.90. On March 3, he withdrew $600. On January 1, B invested Merchandise $2200; on May 1, he invested $400 Cash and withdrew $23.15 worth of Merchandise. On January 1, C invested Cash $1800; Notes $500 with accrued Interest $17.80; Personal Accounts due him $176.40. On January 1, D invested Cash $2000; Merchandise $300 with 4 and 5% off. On June 16, he invested $620 Cash. The losses were $264.18 for Running Expenses, other than the rent which was $275; 3% of Personal Accounts of $3729.70. The gains were $2394.13 on Merchandise; $23.66 Interest. Find the net worth at closing of each partner and also the firm.

475. *To find each partner's gain or loss when the capital of the several partners is invested for the same length of time, and they are to share gains and losses in proportion to the capital invested.*

1. A, B and C enter into copartnership in the grocery business for a term of 2 years. A invested $3600, B invested $4200, C invested $2400. At the close of the partnership term it was found that the net profits of the business had been $3570. What was each partner's portion of the profits?

<div align="center">SOLUTION</div>

$3600 + $4200 + $2400 = $10200 total investment.
$3570 ÷ $10200 = .35 or 35% the rate of gain.
$3600 × .35 = $1260 A's gain.
$4200 × .35 = $1470 B's gain.
$2400 × .35 = $840 C's gain.

2. Two speculators A and B operated together in buying and selling cattle. A made purchases amounting to $2735, and paid expenses amounting to $484.60. B made purchases amounting to $3687.50 and paid expenses amounting to $387.30. The cattle were sold by B for $8214.75. What is the gain or loss? How

will the partners settle between them, the gains or losses to be shared in proportion to their investments?

3. Fuller, Irwin and Diers formed a partnership for 1 year and invested as follows: Fuller invested $1500 Cash. Irwin invested Merchandise $2000; Notes $200. Diers invested, Store $1250; Notes $350; Personal Accounts $200. Their resources at closing were: Cash $3160.35; Merchandise $2500; Notes $320 with Interest due $8.75; Personal Accounts $335.90. The gains were divided in proportion to the partner's investments. What was the total gain and each partner's gain?

NOTE.—Find the net gain or net loss by taking the difference between the investments and the resources at closing, then proceed as in the previous problem.

4. A, B and C engaged in business on August 1, 1901. A invested $2400, B invested $1700, C invested $2900. On August 1, 1902, the resources were as follows: Cash $3850; Merchandise $2690; Notes $1800; Personal Accounts $862.40; Horse and Wagon $285. The liabilities were Personal Accounts $192.40, Bills payable $260. During the year A withdrew $90; B $100; C $85. The gains were divided in proportion to the investment. What was the gain of each?

NOTE.—The withdrawals of partners are resources to the business the same as personal accounts of other parties.

5. Jennings, Fuller and Clark engage in business for a term of two years. Jennings invests $3000; Fuller invests $1980; Clark invests $2370. On closing their books they found their gains as follows: On Merchandise $3194.20; Interest on Bills Receivable $93.60; Discount on their Notes paid before due $28.70. The losses were Running Expenses $150; Rent $200, Personal Accounts $26.50. What was the net gain of each, the gain being shared according to their investments?

6. F, G and H engage in the grocery business, agreeing to share gains and losses in proportion to their investments. F invests $1600; G invests $1800; H invests $2000. At the end of the partnership term they find their gains as follows: On Mer-

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chandise $1480; Discount on bills paid before due $148.30. The losses were: Expenses $540; Bad Debts $78.50. What was the net gain and each partner's share thereof?

476. *To find each partner's gain or loss when the capital of the several partners is invested for different lengths of time, and they are to share gains and losses according to the amount of capital invested and time it is employed.*

1. On January 1, A and B formed a partnership for one year. A invested $1700 on January 1, and $720 on March 1. He withdrew $600 on June 1. B invested $2000 on January 1, and $800 on April 1. He withdrew $750 on May 1. The net gain was $972. What was the gain of each partner?

<div align="center">SOLUTION</div>

Find the time in months from the date of each investment and withdrawal to the end of the year.

A invested $1700 × 12 = $20400
A invested   720 × 10 =   7200
                         $27600 $\Big\}$ use of $23400 for 1 mo.
A withdrew 600 ×   7 =   4200
$23400 ÷ 12 = $1950, A's average investment for 1 year.
B invested $2000 × 12 = $24000
B invested   800 × 9 =   7200
                         $31200 $\Big\}$ use of $25200 for 1 mo.
B withdrew 750 × 8 =   6000
$25200 ÷ 12 = $2100, B's average investment for 1 year.
$1950 + $2100 = $4050 total investment for 1 year.
$972 ÷ 4050 = .24 or 24% gain on investment.
$1950 × .24 = $468 A's gain.
$2100 × .24 = $504 B's gain.

2. Hammond and Cowles formed a partnership to run for 1 year from September 10, 1905. Hammond invested $3500 on September 10, $1800 on December 10, and $600 on March 10, 1906. Cowles invested $4200 on September 10, and $900 on January 10, 1906. The net gain of the firm was $1990. What was each partner's gain?

3. On March 1, 1905, Manning, Miller and Collins formed a partnership for 10 months. Manning invested $1400 on March 1, and $1250 on June 1. Miller invested $1760 on March 1, and $2400 on May 1. Collins invested $2100 on March 1, and $800 on August 1. The firm gained $5500.80. What was each partner's gain?

4. F. M. Tyler, H. F. Brady and P. W. Hess formed a partnership on July 1, 1905, for 1 year. Tyler invested $4600 on July 1 and $1200 on December 1. He withdrew $1800 on February 1, 1906. Brady invested $7400 on July 1, and withdrew $2400 on January 1, 1906. Hess invested $6500 on July 1 and $3000 on March 1, 1906. The firm's net loss for the year was $1245. What was the loss of each partner?

5. On May 18, 1905, A and B formed a partnership for 1 year. A invested $4000 on May 18 and $2700 on September 18. B invested $3500 on May 18 and $1800 on October 18. A withdrew $1900 on November 18 and $600 on January 18, 1906. B withdrew $900 on July 18 and $2100 on February 18, 1906. The net gain of the firm was $1589.50. Find the gain per cent. on the investment and each partner's net gain.

6. On January 1, 1905, A, B and C formed a partnership which was dissolved August 20, 1905. At the beginning of the business each invested $2500. A invested $800 on April 11. B invested $950 on June 3. C withdrew $500 on May 30. The resources at closing were cash $8200, Merchandise $1650, Notes $840. Find each partner's gain or loss, there being no liabilities other than the investments.

Note.—Count the exact days in finding the time.

477. *To find each partner's gain or loss when interest is allowed on the investments and charged on the withdrawals.*

1. On April 1, 1905, A and B formed a partnership for one year. A was to share $\frac{5}{12}$ of the gain or loss and B $\frac{7}{12}$. Each partner was to receive interest on his investments and pay interest on his withdrawals at 6%. The net gain for the year was $2772. What was the capital of each on April 1, 1906? The accounts on April 1, 1906, were as follows:

Dr.			A.				Cr.
1905				1905			
Sept.	1	Cash	1200	April	1	Cash	8000
1906				Aug.	1	Mdse.	3000
Jan.	1	Bills Pay.	800				

Dr.			B.				Cr.
1905				1905			
Oct.	16	Cash	900	April	1	Cash	15000

SOLUTION

Find the interest on each investment or withdrawal from its date to the date of settlement.

A.

Int. on $8000 for 1 yr. = $480.

Int. on $3000 for 8 mo. = $120.

$480 + $120 = $600, A's credit interest.

Int. on $1200 for 7 mo. = $42.

Int. on $800 for 3 mo. = $12.

$42 + $12 = $54, A's debit interest.

$600 — $54 = $546, A's net credit interest.

B.

Int. on $15000 for 1 yr. = $900, B's credit interest.

Int. on $900 for 5½ mo. = $24.75, B's debit interest.

$900 — $24.75 = $875.25, B's net credit interest.

Carry the interest items to the Cr. side of the partner's accounts and Dr. side of Profit and Loss. Then close Profit and Loss account and credit each partner with his portion of the gain.

PROFIT AND LOSS

A's interest........ $546.00	Net gain.......... $2772.00
B's interest........ 875.25	
A's net gain *562.82*	
B's net gain *787.93*	
$2772.00	$2772.00

A		B	
Cash $1200	Cash $8000	Cash.........$900	Cash ...$15000
Bills Pay, 800	Mdse.... 3000	Net cap.,$15763.18	Interest 875.25
Net cap.,$10108.82	Interest . 546		*Net gain* 787.93
	Net gain. 562.82		

2. Wakeham, Griffin and Scallard formed a partnership on January 1, 1905, for 1 year; the gains and losses to be shared equally. Interest is allowed at 8% on all sums invested and withdrawn. On January 1, Wakeham invested $5000; on March 1, $1400. He withdrew $600 on June 1, and $300 on September 16. On January 1, Griffin invested $7500; on June 16, $1000. He withdrew $1500 on March 1, and $450 on July 1. On January 1, Scallard invested $9000; on July 1, $1600. He withdrew $600 on April 1. They gained during the year $11916. What is each partner's capital on January 1, 1906?

3. On September 1, 1905, A, B, C and D formed a partnership for 16 months. Interest on partners' accounts is 6%. A is to share $\frac{1}{6}$ of the gain or loss; B, $\frac{1}{4}$; C, $\frac{1}{3}$; D, $\frac{1}{4}$. A invested $4000 on September 1; B, $6000 on September 1, $1500 on March 1; C, $8000 on September 1, $2000 on August 16, 1906. D, $10000 on September 1, $2400 on January 1, 1906; $900 on June 16, 1906. B withdrew $900 on January 1, 1906; C, $1800 on September 1, 1906; D, $1600 on March 16, 1906; $840 on August 1, 1906. The net loss during the partnership was $21792. What was each partner's net credit interest and net capital at closing?

4. B. A. Harding, E. D. Wilson and J. P. Farrel formed a partnership for one year from August 20, 1905. Harding shared 25% of the gain or loss; Wilson, 35%; Farrel, 40%. Interest was allowed on all investments and withdrawals at 10%. Harding managed the business at a salary of $1200. At the beginning of the business Harding invested $2500; Wilson, $3500 in Merchandise with 3% and 5% off; Farrel, $4000. On January 1, 1906, Harding withdrew $800; Wilson invested $1500; Farrel invested $500. At the close of the business the net gain, not including A's note of $300 which Farrel took at 60% of its face, was $2786.40. What was each partner's capital at closing, no interest being allowed on the salary?

Notes.—1. When the time is less than one year find the time by counting the exact number of days.

2. After opening the Profit and Loss Account, charge it with 40%

of A's note, and charge the remaining 60% to Farrel, and credit Profit and Loss with full amount.

3. Salaries are credited to the partners who earn them and charged to Profit and Loss account the same as interest.

5. A and B formed a partnership on January 1, 1905. A is to conduct the business and receive 65% of the gain, and B, whose time is not employed, is to receive 35% of the gain. On January 1, A invests $4000; on May 3, $1200, and withdraws $1600 on June 15. On January 1, B invests $3800; on March 23, $1800; and withdraws $860 on July 1. Each partner is to receive 8% interest on the amounts he invests, and pays 8% interest on all amounts which he withdraws; the interest is to be adjusted on the basis of each receiving $\frac{1}{2}$ of the gain. The partnership was dissolved on August 25, 1905, with a cash resource of $12000. They owed $450 to C, which B assumes. How much of the cash should each receive?

NOTES.—1. Find the time by counting exact days.

2. Since the interest is not adjusted on the same basis as other profits, it will be necessary to make up the Profit and Loss account with the interest only, and find remainder of gain or loss from the resources and liabilities.

6. A, B and C commenced business on June 1, 1905, with resources as follows: A invested cash $4000, Merchandise $1800, Fixtures $250. B invested Store $4800, Cash $2750, Personal Accounts $800. C invested Cash $6000, Notes $1200, Accrued Interest $120. The firm assumed a mortgage of $2500 on the store, and A's note of $1450. A was to share 30% of the gain or loss; B, 35%; C, 35%. B was allowed $800 per year for keeping the books. On June 1, 1906, A invested $1500; B withdrew $1150; C invested $2000. On January 1, 1907, each partner withdrew $1000. June 1, 1907, the partners agreed upon a dissolution, the ledger showing:

RESOURCES.		LIABILITIES.	
Cash	$9786.20.	Notes	$940.
Mdse.	$2314.30.	Interest on notes	$30.
Notes	$1420.	Mortgage-balance	$1500.
Real estate	$4000.	B for salary	$1600.
Personal accts.	$2694.40.		

Find the net gain or loss not counting interest on the partners' accounts. What was each partner's net worth at closing, if interest was allowed at 9%? (No interest allowed on B's salary.)

7. J. W. White and H. Murray associating together, purchased a flouring mill for $8400, in which White holds a two-thirds interest and Murray one-third. During the year White paid out on account of the mill $1548.26, and received $4862.48. Murray paid out $956 and received $2686.40. A settlement is now made, the mill having just been sold for $9000; $4500 received in cash and the balance a note at 60 days which both agree that White may take to apply on his account at 20% discount; and the $4500 is then properly divided between them; make the division.

INVOLUTION

478. A *Power* is the product obtained by multiplying a number by itself, or using it as a factor. Thus, $9 = 3 \times 3$ is the second power of 3; $27 = 3 \times 3 \times 3$ is the third power of 3.

479. *The Exponent* of a power is the number denoting how many times the factor is repeated. The exponent is usually a small figure, placed at the right and a little above the factor. Thus, 3^2 signifies that 3 is to be raised to the second power; 3^3 signifies that 3 is to be raised to the third power, etc.

480. *The Square* of a number is the second power of the number.

481. *The Cube* of a number is the third power of the number.

482. *Involution* is the process of raising any number to a given power.

From the preceding we have the following:

To Raise Any Number to a Given Power

a. Multiply the number by itself until it has been used as often as there are units in the exponent of the power.

1. Find the second power of 18.
2. What is the third power of 54?
3. What is the second power of 4.36?
4. Find the fourth power of 75.
5. What is the sixth power of 1.12?
6. What is the second power of 4.86?
7. What is the fifth power of 4?
8. Find the third power of .3 to three places.
9. What is the third power of $\frac{7}{9}$?
10. What is the fifth power of 1.04?
11. Raise 1.05 to the sixth power.
12. What is the eighth power of $\frac{3}{5}$?
13. What is the second power of $4\frac{7}{8}$?
14. Expand the expression 6^5.

15. What is the second power of $5\frac{1}{2}$?

16. What part of 8^3 is 2^6.

17. What is the difference between 5^6 and 4^6?

18. Expand $3^5 \times 2^4$?

19. Express with a single index, $47^3 \times 47^5 \times 47^6$.

20. How many acres are in a square lot, each side of which is 135 rods?

21. What is the sixth power of .01?

22. What is the fourth power of .03?

23. What is the fifth power of 1.05?

24. What is the third power of .001?

25. What is the second power of .0044?

26. Each side of a room is 12 feet long. How many square yards of carpet will be required to cover the floor?

27. A box in cubical form is $6\frac{1}{4}$ feet long on any inner side. How many cubic inches will it contain?

28. From 2.125^4 subtract $1\frac{1}{16}^3$.

29. From the fifth power of $\frac{3}{5}$ take the fourth power of $\frac{2}{7}$.

EVOLUTION

483. *A Root* is the number which is multiplied by itself a given number of times to produce a given power.

484. *Evolution* is the process of finding or extracting the root of a power. Evolution is the exact reverse of Involution.

485. *The Radical Sign* is a character $\sqrt{}$ placed over the number considered as the power to indicate that the root is to be extracted.

486. The *Index* of the root is a small figure placed above the radical sign to indicate what root is to be extracted. Thus $\sqrt[3]{}$ indicates that the third or cube root of 64 is to be extracted. The square root is indicated by the radical sign alone without any index.

487. *A Perfect Power* is a number whose root can be exactly extracted. Thus 64 is a perfect power whose third or cube root is 4.

488. *An Improper Power* is a number whose root cannot be exactly extracted. Thus 10 whose square root is 3.1622+.

The only roots that are of much practical use are the *Square* and *Cube* roots.

SQUARE ROOT

489. The *Square Root* of a number is one of the two equal factors that produce the number. Thus the square root of 25 is 5.

By trial and inspection we find that the square of any number has twice as many or one less than twice as many figures as the number. Hence the square root of a number will contain as many figures as one-half the number of figures in the power and one figure more for an odd figure in the power.

1. Find the square root of 576 sq. ft.

SOLUTION

$$5'76\underline{|24}$$
$$\underline{4}$$
$$44\underline{|176}$$
$$\underline{|176}$$

20 FT

20×20=400 SQ FT.   20 FT

20 FT

20 FT
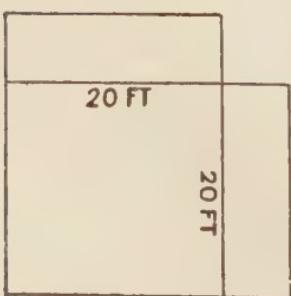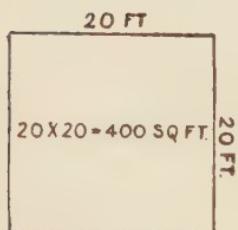
EXPLANATION.—Pointing off the power into periods of two places each by the principle just laid down we see that there will be two figures in the root. Now it is required to construct a square which shall contain 576 sq. ft. We can see that the root of the left period is 2 and since there will be two figures in the root, this must be 2 tens or 20 ft. Construct a square which shall be 20 feet on each side as in the diagram. The surface of this square is 20 × 20 = 400 sq. ft. But subtracting this 400 ft. (expressed as 4 in hundreds place in the solution) we still have 176 sq. ft. Our square must be increased to absorb this 176 sq. ft. This can be done by adding to two sides, and still retain the figure as a square. These two additions will together be 40 ft. long, and this explains why we "double the root already found," in the solution. Now the length of our additions being 40 ft. the width will be as much as the length is contained times in the area. 176 ÷ 40 = 4 ft. and this gives the second figure of the root. But our square is not yet complete. We still require a corner which we find is 4 ft. square. This corner added to the additions on the two sides gives the length of the three additions as 44 ft.
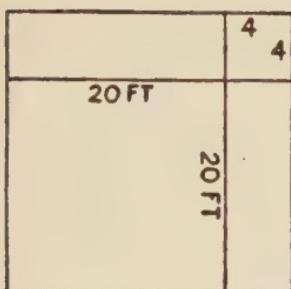
and thus may be seen why we add the last fig-
ure of the root to double the first. 44 ft. being
the length of our additions and 4 ft. being their
width, multiplying we have 176 sq. ft. as the
area, and this we find exactly absorbs the re-
maining area given in the power.

We have therefore constructed a square,
each side of which is 24 feet long, and the
area of which exactly equals the area given,
therefore we conclude that 24 feet, the length
of one side is the square root of the given area,
576 feet.

From this solution and explanation we have the following:

To Find the Square Root

*a. Begin at the right hand and point off in periods of two
figures each.*

*b. Find the greatest square in the left hand period and place its
root in the quotient.*

*c. Subtract the square from the left hand period and bring
down the next period.*

*d. Double the root already found and place this at the left of
the dividend for a trial divisor. Find how often this is contained
in the dividend, exclusive of the right hand figure, and place the
quotient in the result as the second figure of the root.*

*e. Annex the last figure of the root to the trial divisor for the
complete divisor. Multiply the complete divisor by the last figure
of the root, write this under the dividend, subtract, bring down
the next period if any, and continue as before.*

NOTE.—The square root of a fraction consists of the square root
of its numerator over the square root of its denominator.

Or, the fraction may be reduced to a decimal and then the root ex-
tracted.

2. Find the square root of 1024.

3. Find the square root of 1849.

4. Find the square root of 4225.

5. Find the square root of 61504.

6. Find the square root of 444889.

  7. Find the square root of 390625.

  8. Find the square root of 1679616.

  9. Find the square root of $\frac{49}{625}$.

  10. Find the square root of $30\frac{1}{4}$.

  11. Find the square root of $\frac{847}{1183}$.

  12. Find the square root of $277\frac{7}{9}$.

  13. Find the square root of $\frac{3}{4}$.

  14. Find the square root of 3.

  15. Extract the square root of $\frac{2}{3}$.

  16. Extract the square root of $17\frac{3}{8}$.

  17. Extract the square root of .008836.

  18. Extract the square root of .00006561.

  19. What is the value of $\sqrt{3}$?

  20. What is the value of $\sqrt{125}$?

APPLICATIONS OF SQUARE ROOT

490. *An Angle* is the space included between two straight lines which meet. Thus the two lines B A and C A meet and form an angle at A.

491. *A Triangle* is a figure bounded by three straight lines. The accompanying figure is a triangle.

492. *A Right-Angle* is the space between two lines when one is perpendicular to the other. Thus the angle at B is a right-angle.

493. *A Right-Angled Triangle* is a triangle having in it a right angle.

494. *The Hypotenuse* is the longest side, or the slanting side. Thus A C is the hypotenuse.

495. *The Base* is the side upon which the triangle rests. Thus B C is the base.

496. *The Perpendicular* is the side which stands at right angles with the base. Thus A B is the perpendicular.
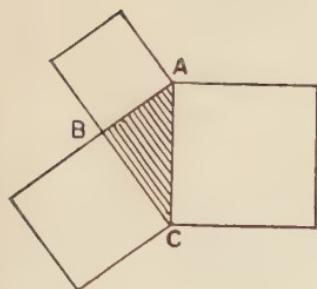
It is a known principle, discovered and demonstrated over two thousand years ago by a Greek philosopher and mathematician that *the area of the square described on the hypotenuse of a right-angled triangle is equal to the sum of the areas of the squares described on the other two sides.*

From this principle we have the following :

To Find the Hypotenuse

a. Add the square of the base and perpendicular together and extract the square root.

To Find Either of the Shorter Sides

Subtract the square of the given side from the square of the hypotenuse, and extract the square root.

1. The base of a right-angled triangle is 30 ft. and the perpendicular is 40 ft. What is the hypotenuse ?

2. The base of a right-angled triangle is 18 ft. and the hypotenuse is 22 ft. What is the perpendicular ?

3. The perpendicular of a right-angled triangle is 64 inches and the hypotenuse is 82 inches. What is the length of the base ?

4. A church steeple is 128 ft. high and stands 72 feet from the opposite side of the street. What is the length of a rope which will reach from the top of the steeple to the opposite side of the street ?

5. A window is 16 ft. 4 in. from the ground. What length of a ladder the foot of which placed 14 ft. 8 in. from the house, will reach to the window ?

6. A square field contains 40 A. How many rods of fence will be required for one side of it? How many rods of fence will be required to entirely enclose it ?

7. A city lot in the form of a rectangle contains 5650 sq. ft. and its length is twice its width. What are its dimensions ?

8. A maypole broke off 23 ft. from the ground and in falling the top struck the ground 14 ft. from the bottom of the pole. How high was the pole ?

9. A park is one mile square. What is the length of a diagonal path across it?

10. How many rods of travel does A save who goes diagonally across a field 1 mile square in preference to going by its two sides?

11. A room is 30 feet long, 25 feet wide and 12 feet high. What is the distance from one of the lower corners of the room to the opposite upper corner?

CUBE ROOT

497. The *Cube Root* of a number is one of three equal factors which produce the number. Thus the cube root of 64 is 4.

By trial we find that the cube of any number consisting of one figure can never exceed three figures, the cube of a number consisting of two figures can never exceed six figures, etc. Hence if we point off the power into periods of three figures each the number of periods will indicate the number of figures in the root.

1. Find the cube root of 91125 cu. in.

SOLUTION

```
   91'125|45
   64      ——
4800|27125
 600|
  25|
5425|27125
    |
```
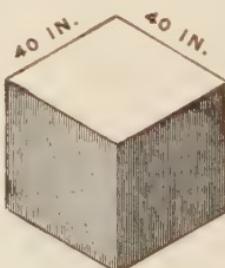

EXPLANATION.—Pointing off the power into periods of three places each, by the principle just given, we see that the root will contain two places. It is required to construct a cube which shall contain 91125 cu. in. We see by inspection that the cube root of the left period is 4 and since there are to be two figures in the root this is 4 tens or 40. Construct a cube which shall be 40 in. on each side as in the diagram. The solid contents of this cube is $40 \times 40 \times 40 = 64000$ cu. in. But subtracting the 64000 cu. in. (expressed in the solution as 64 in thousands place) we still have 27125 cu. in. left. Our cube must be increased so as to absorb this, which can be done by adding to three sides of the cube, and still re-

tain its cubical form. The surface of one face of the cube contains $40 \times 40 = 1600$ sq. in. and 3 faces will contain 3 times 1600 sq. in. or 4800 sq. in. This explains why we "square the root found and multiply it by 300 for a trial divisor," 300 being used instead of 3 because we have used the root found as units when they are really tens. We find that our trial divisor is contained in the dividend 5 times and this gives us the thickness of the additions. But our cube is not yet perfect. We must add three rectangular pieces at the corners. These pieces will be 40 in. long and 5 in. wide and there being three of them their surface will be $40 \times 5 \times 3 = 600$ sq. in. This explains why we "multiply the last figure of the root by the last and by 30;" 30 being used instead of 3 because we called the 40 four units instead of 4 tens, which they really are. But our cube is still imperfect. We must add a small block at the corner. This will be 5 in. long and 5 in. wide and hence its surface will be $5 \times 5 = 25$ sq. in. which is also written in the divisor. Our complete divisor then is 5425 sq. in. which is the surface of all of the additions that we have made. Now multiplying this by the thickness, 5 in., we have the solid contents of all of these additions, 27125 cu. in. and this, we find, exactly consumes the cubical contents given.

From this solution and explanation we have the following:

To Find the Cube Root

a. Begin at the right hand and point off in periods of three places each.

b. Find the greatest cube in the left hand period and place its root in the quotient.

c. Subtract the cube from the left hand period and bring down the next period.
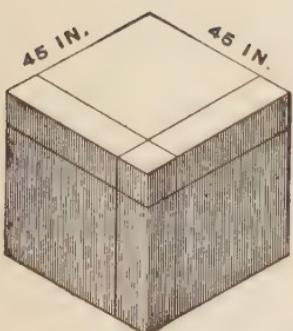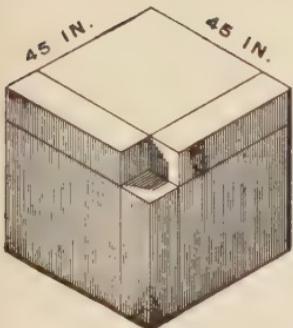
d. Square the root found and multiply it by 3 for a trial divisor and affix or add two ciphers. Find how often this is contained in the dividend and place the quotient in the result as the next figure of the root.

e. Multiply the last figure of the root by the rest and by 3 and add or affix one cipher, and write the result under the trial divisor.

f. Square the last figure of the root and place the result under the trial divisor.

g. Add together the trial divisor and the two quantities beneath it and this will be the complete divisor which multiply by the last figure of the root. Write the product under the dividend, subtract, bring down the next period, if any, and continue as before.

2. Find the cube root of 46656.

3. Find the cube root of 250047.

4. Find the cube root of 2000376.

5. Find the cube root of 5545233.

6. Find the cube root of 10077696.

7. Find the cube root of 46268279.

8. Find the cube root of 85766121.

9. Find the cube root of 153990656.

10. Find the cube root of 250047000.

11. What is the cube root of 926.859375?

12. What is the cube root of 44.6?

Extract the cube root of the following numbers:

13.	$\sqrt[3]{1}$	*16.*	$\sqrt[3]{9}$
14.	$\sqrt[3]{2}$	*17.*	$\sqrt[3]{13.}$
15.	$\sqrt[3]{3}$	*18.*	$\sqrt[3]{\frac{27}{64}}$

APPLICATIONS OF CUBE ROOT

1. What is each side of a square box, the solid contents of which is 59319 cu. inches?

2. What is the length of each side of a cubic vessel whose solid contents is 2936.493568 feet?

3. A store has its length, breadth and height all equal; it can hold 185193 cubic feet of goods; what is each dimension?

4. How many linear inches must each dimension of a cubic vessel be which can hold 997002999 cubic inches of water?

5. What will be the length and depth of a bin which shall contain 160 bushels of corn, if its length is twice its width, and its depth and width are equal?

6. A bin is 18 ft. long, 12 ft. wide and 10 ft. deep. What must be the length of a cubical bin having the same volume?

7. Give the dimensions of a cube having the same volume as a box 5 ft. 4 in. long, 2 ft. 8 in. wide and 3 ft. 6 in. deep.

8. What is the surface of the six faces of a cube containing 91125 cubic feet?

9. A cistern in the form of a cube holds 150 barrels of water. What is each of its dimensions?

10. A cubical bin holds 350 bushels of wheat. What is its length?

11. Find the length of a cubical cistern which holds 5000 gallons of water.

MENSURATION

498. *Mensuration* is the art of computing *lengths, surfaces* and *volumes.*

499. A *Line* is that which has length only. All lines in mensuration and surveying are imaginary.

500. A *Straight Line* is the shortest distance between two points.

501. A *Curved Line* is a line having no part straight.

502. A *Horizontal Line* is a line parallel with the horizon, or with the water level.

503. A *Vertical Line* is a line perpendicular to the horizon.

504. An *Angle* is the space between two lines which meet.

Thus the space between the lines A C and B C is an angle, called the angle A C B.

505. A *Right Angle* is an angle formed by the meeting of a horizontal line and a perpendicular line.

Right angle. | Right angle.
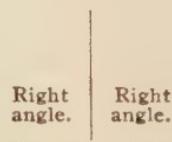
An *obtuse angle* is one which is greater than a right angle. An acute angle is one which is less than a right angle.

506. A *Surface* is that which has length and breadth.

Obtuse angle. | Acute angle.
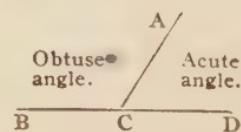
A *Plane* is a surface such that any two points of it can be joined by a straight line, which lies wholly in the surface. The application of a straight line is the test of a plane.

507. *Area* is a term applied to the quantity of surface contained in a figure having only length and breadth.

508. A *Solid* is that which has length, breadth and thickness.

PLANE FIGURES

509. *To find the area of a square or rectangle.*

510. A *Square* is a figure having four equal sides.

<div style="text-align: center">A SQUARE.</div>

511. A *Rectangle* is a figure having four right angles and its opposite sides equal.

The reason for the following rule will be found by referring to Art. 172.
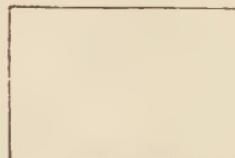
<div style="text-align: center">A RECTANGLE.</div>

Rule. Multiply the length by the breadth, and the product will be the surface or area.

PROBLEMS

1. What will it cost to pave a sidewalk 80 ft. long and 15 ft. wide at $1.50 per sq. yard?

2. How much will a farm cost which is 185 rods long and 125 rods wide at $45 per acre?

3. How many small squares each containing 4 square inches, are contained in a large one which is 4 feet square?

4. What will it cost to plaster a room 15 ft. 6 in. long 12 ft. 9 in. wide and 10 ft. 3 in. high at $37\frac{1}{2}$ cents per square yard?

5. How many yards of carpeting $\frac{3}{4}$ yd. wide will cover a floor 16 ft. 9 in. long by 15 ft. 9 in. wide, if laid lengthwise?

512. *To find the area of a triangle.*

513. The *Base* of a triangle is the side on which it rests.

514. The *Altitude* of a triangle is the perpendicular distance from the base to the opposite angle called the apex.

Since every angle in equivalent to one-half of a square or parallelogram having the same base, we may find the area of the squares or parallelogram and divide by two, or according to the following:

Rule. Multiply the base of the triangle by its height, and divide the result by two.

PROBLEMS

1. How many square yards in a triangle whose base is 27 yards and altitude 36 yards?

2. The gable end of a house was 34 ft. 6 in. from eave to eave and the perpendicular height of the ridge above the eaves is 13 ft. How many feet of boards will be required to cover three such gables?

3. A lot of ground 80 ft. long by 20 ft. wide was cut diagonally by a railroad, leaving a triangular plot of the same base and altitude; what was its area?

4. What is the rent of a triangular field whose base is 80 rods and perpendicular height 48 rods, at $4.50 per acre?

515. *To find the circumference or diameter of a circle.*

516. A *Circle* is a plane figure bounded by a curve line, every part of which is *equally distant* from a point within called the *center.*

517. The *Circumference* of a circle is the curved line by which it is bounded.

518. The *Diameter* is a *straight line* drawn through the *center,* terminating at each end in the *circumference.*

519. The *Radius* is a straight line drawn from the center to the *circumference,* and is equal to *half* the diameter.

It has been proven in geometry that the circumference of every circle great or small is 3.1416 times its diameter, hence the

Rule. a. To find the circumference of a circle multiply the diameter by 3.1416.

b. To find the diameter of a circle divide the circumference by 3.1416.

PROBLEMS

1. What is the diameter of a circular piece of land measuring $5\frac{1}{2}$ miles around it?

2. The diameter of a circular race course is ⅜ of a mile, how many rods of fence will be required to enclose it?

3. A circular park is two miles in circumference; what is its diameter?

4. A horse is fastened to a tree by a rope 37½ feet long. What is the circumference of the circle in which he may graze?

5. What is the diameter of a wheel which makes 420 revolutions in a minute when the cars are running at the rate of 45 miles per hour?

520. *To find the area of a circle.*

Rule. Multiply the diameter by the circumference and divide the product by 4. Or, multiply the square of the diameter by .7854.

PROBLEMS

1. What is the area of a circle whose diameter is 36 feet?

2. A circular park requires 145 rods of fence to enclose it, how many acres does it contain?

3. Find the area of a space on which a horse may graze when confined by a rope 125 feet long.

4. A circular fish pond has a radius of 75 feet; what is its area?

5. How many square feet in a circular grass plot 75 feet in diameter?

SOLIDS

521. A *Solid* is that which has length, breadth and thickness.

522. A *Prism* is a solid whose bases are similar, equal and parallel, and whose sides are parallelograms.

523. All rectangular solids are prisms.

524. A *Right Prism* is one whose sides are perpendicular to its bases.

525. A *Rectangular Prism* is one whose bases are rectangular and its sides perpendicular to its bases.

526. A *Triangular Prism* is one whose bases are triangles.

NOTES.—1. Prisms are named from the form of their bases, as *triangular, quadrangular, pentagonal, hexagonal,* etc.

2. When their sides are all equal to each other they are called *cubes*.

527. A *Cylinder* is a round prism, or one having circles for its ends.

528. A *Pyramid* is a solid having for its base any plane figure and for its sides triangles which terminate in a common point called the vertex.

529. A *Cone* is a body which has a circle for a base and whose sides terminate in a point called the vertex.

530. A *Frustum* of a pyramid or cone is the part which is left after the top is cut off by a plane parallel or inclined to the base.

531. *To find the surface of a prism or any figure having plain sides.*

Rule. Find the area of each surface separately, and add the results.

PROBLEMS

1. Each side of a triangular prism is 3 ft. long and 9 inches wide. What is the area of its surface, not including the ends?

2. What is the area of a pyramid having 6 sides each 2 feet at base by 6 feet in slant height?

532. *To find the convex surface of a cylinder.*

Rule. Multiply the circumference of the base by the altitude.

PROBLEMS

1. How many square feet of surface in the sides of a cylinder 16½ feet long and 12 feet in circumference?
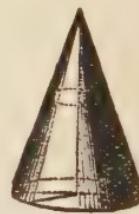
2. A smoke stack is 40 feet high and 9 feet 4 inches in circumference. How many square feet of sheet iron are contained in it?

3. What is the surface including the ends, of a cylinder 5 feet long and 1½ feet in diameter?

4. A log is 60 ft. long and 10 ft. in circumference. What is the surface of its sides?

533. *To find the solid contents of a prism or cylinder.*

Rule. Multiply the area of the base by the altitude.

PROBLEMS

1. Find the solid contents of a square prism, the base being 5 feet each side, and 17 feet high.

2. A well is 45 feet deep and 4 feet in diameter. How many gallons of water will it hold?

3. A cistern is 8 feet by 6 feet and 14 feet deep. What is its solid contents in gallons?

534. *To find the solid contents of a pyramid or a cone.*

It has been demonstrated in geometry that a pyramid is ⅓ of a prism of the same base and height and a cone is ⅓ of a cylinder of the same base and height.

Rule. Multiply the area of the base by the altitude and divide by 3.

PROBLEMS

1. What are the contents of a pyramid whose base contains 144 square feet and its altitude is 36 feet?

2. What are the contents of a cone whose base contains 3624 square feet and its altitude is 27 feet?

3. A monument in the form of a pyramid is 18 ft. 6 in. by 16 ft. 9 in. at the base, and its altitude is 67 ft. 3 in. What is the amount of solid stone contained in it?

4. A pyramid is 430 ft. high and each side of its base is 520 feet. What are its solid contents?

535. *To find the surface of a globe, the circumference and diameter being given.*

536. A *Globe* or sphere is a body every point of the surface of which is equally distant from a point within called the center.

537. The *Diameter* of a sphere is a straight line passing through the center and terminating both ways at the circumference.

538. A *Hemisphere* is half a sphere.

Rule. Multiply the square of the diameter by 3.1416.

PROBLEMS

1. A perfect sphere is 34 feet in diameter. What is its surface?

2. What will it cost to gild a ball 12 inches in diameter at 10 cents a square inch?

3. If the earth is 7912 miles in diameter what is its area, supposing it to be a perfect sphere?

539. *To find the solid contents of a sphere.*

Rule. Multiply the cube of the diameter by .5236.

PROBLEMS

1. What is the solid contents of a cannon ball 15 inches in diameter?

2. A balloon is 30 ft. in diameter. How many cubic feet of gas does it contain, supposing it to be a perfect sphere?

3. The basin of a fountain is a hemisphere $22\frac{1}{3}$ ft. in diameter; what are its cubical contents?

4. How many hogsheads of water will it contain?

METRIC SYSTEM

540. The *Metric System* of weights and measures is a system in which the denominations increase and decrease by the decimal scale.

The metric system originated in France, and on account of its simplicity has been adopted in nearly all European countries, Mexico, South America, and in 1866 by the Congress of the United States. Its use in the United States has not become general, but is confined mostly to the arts and sciences, the coast survey and a portion of the mint and post office. For this reason the subject will not be extensively treated in this book.

541. The *Meter* is the base of the system and is one ten millionth part of the distance from the equator to the pole, or 39.37 inches, nearly.

The Metric System has three principal units, the Me'ter (meeter), Li'ter (leeter) and Gram. To these are added the *Ar* and *Ster* for square and cubic measure. Each of these units has its multiples and divisions.

542. The *Lower Denominations* are formed by prefixing to the name of the unit, dec'i, cen'ti and mil'li.

Thus from *dec'i*, $\frac{1}{10}$ we have dec'i me'ter $\frac{1}{10}$ meter.

from *cen'ti*, $\frac{1}{100}$ we have cen'ti me'ter $\frac{1}{100}$ meter.

from *mil'li*, $\frac{1}{1000}$ we have mil'li me'ter $\frac{1}{1000}$ meter.

543. The *Higher Denominations* are formed by prefixing to the name of the unit, dek'a, hek'to, kil'o and myr'ia.

Thus from *dek'a,* 10 we have dek'a me'ter 10 meters.

from *hek'to,* 100 we have hek'to me'ter 100 meters.

from *kil'o,* 1000 we have kil'o me'ter 1000 meters.

from *myr'ia,* 10000 we have myr'ia me'ter 10000 meters.

Metric Linear Measure

TABLE

10 *mil′li-me′ters* (*mm.*)	= 1 **Cen′ti-me′ter**............. *cm.* ($\frac{1}{100}$ *m.*)
10 cen′ti-me′ters	= 1 dec′i-me′ter .... *dm.* ($\frac{1}{10}$ *m.*)
10 dec′i-me′ters	= 1 **METER** .... *m.*
10 me′ters	= 1 dek′a-me′ter .... *Dm.* (10 *m.*)
10 dek′a-me′ters	= 1 hek′to-me′ter .... *Hm.* (100 *m.*)
10 hek′to-me′ters	= 1 **Kil′o-me′ter**............. *Km.* (1000 *m.*)
10 kil′o-me′ters	= 1 myr′ia-me′ter........... *Mm.* (10000 *m.*)

NOTES.—1. The principal unit of each table is printed in capital letters; those in common use in full-faced Roman.

2. The *Accent* of each *unit* and *prefix* is on the *first* syllable, and remains so in the compound words.

3. Abbreviations of the higher denominations begin with a *capital*, those *of the lower* with a *small* letter.

Metric Square Measure

TABLE

100 square centimeters, sq. cm. = 1 square decimeter = 15.5 + sq. in.

100 square decimeters, sq. dm. = 1 square meter = 1.196 sq. yd.

NOTE.—It will be observed that the units of square measure are the squares of the units of linear measure. Therefore 100 units of any denomination are the equivalent of 1 unit of the next higher denomination.

Metric Land Measure

TABLE

1 centare, ca. = 1 sq. M.

100 centare   = 1 are, A.

100 A   = 1 hectare.

NOTE.—The hectare is the unit used in the measurement of land as the acre is the common unit in this country. It is the equivalent of 10,000 square meters.

Metric Cubic Measure

TABLE

1000 cu. millimeters, cu. mm. = 1 cu. centimeter.

1000 cu. centimeters, cu. cm. = 1 cu. decimeter.

1000 cu. decimeters, cu. dm. = 1 cu. meter.

NOTE.—It will be observed that the units of cubic measure are the cubes of the units of linear measure. Therefore 1000 units of any denomination are the equivalent of 1 unit of the next higher denomination.

Metric Wood Measure

TABLE

10 decisters, ds. = 1 ster.
10 sters, s.   = 1 dekaster.

NOTE.—In wood measure the ster is the unit. It is the equivalent of one cubic meter.

Metric Measure of Capacity

TABLE

1 milliliter, ml. = $\frac{1}{1000}$ of a liter.
10 milliliters   = 1 centiliter, cl.
10 cl.   = 1 deciliter, dl.
10 dl.   = 1 liter, l.
10 l.   = 1 dekaliter, Dl.
10 Dl.   = 1 hectoliter, Hl.
10 Hl.   = 1 kiloliter, Kl.

NOTE.—There is but the one table for both dry and liquid measure and the unit is the liter. The liter is the equivalent of a cubic decimeter, 1.0567 wine quarts or .908 dry quarts.

Measure of Weight

TABLE

1 decigram, dg. = $\frac{1}{10}$ gram = 1.543 gram
10 dg.   = 1 gram, g.
10 g.   = 1 dekagram, Dg.
10 Dg.   = 1 hectogram, Hg.
10 Hg.   = 1 kilogram, Kg. or Kilo.
10 Kg.   = 1 myriagram, Mg.
10 Mg.   = 1 quintal, Q.
10 Q.   = 1 ton.

In the metric system there is but one table of weight, all articles both heavy and light being measured by it.

Tables of Equivalents

LINEAR MEASURE

1 inch = 2.54 centimeters.
1 foot = .3048 of a meter.
1 yard = .9144 of a meter.
1 rod = 5.029 meters.
1 mile = 1.6093 kilometers.

1 centimeter = .3937 of an inch.
1 decimeter = .328 of a foot.
1 meter = 1.0936 yards.
1 dekameter = 1.9884 rods.
1 kilometer = .62137 of a mile.

SQUARE MEASURE

1 sq. inch = 6.452 sq. centimeters.	1 sq. centimeter = .155 of a sq. inch.
1 sq. foot = .0929 of a sq. meter.	1 sq. decimeter = .1076 of a sq. foot.
1 sq. yard = .8361 of a sq. meter.	1 sq. meter = 1.196 square yards.
1 sq. rod = 25.293 of a sq. meter.	1 are = 3.954 sq. rods.
1 acre = 40.47 ares.	1 hectare = 2.471 acres.
1 sq. mile = 259 hectares.	1 sq. kilometer = .3861 of a sq. mile.

CUBIC MEASURE

1 cu. inch = 16.387 cu. centimeters.	1 cu. centimeter = .061 of a cu. inch.
1 cu. foot = 28.317 cu. decimeter.	1 cu. decimeter = .0353 of a cu. ft.
1 cu. yard = .7645 of a cu. meter.	1 cu. meter = 1.308 cu. yard.
1 cord = 3.624 ster.	1 ster = .2759 of a cord.

MEASURES OF CAPACITY

1 liquid quart = .9463 of a liter.	1 liter = 1.0567 liquid quarts.
1 dry quart = 1.101 liter.	1 liter = .908 of a dry quart.
1 liquid gallon = .3785 of a dekaliter.	1 dekaliter = 2.6417 liquid gallons.
1 peck = .881 of a dekaliter.	1 dekaliter = 1.135 pecks.
1 bushel = .2524 of a hektoliter.	1 hektoliter = 2.8375 bushels.

MEASURES OF WEIGHT

1 grain, Troy = .0648 of a gram.	1 gram = .03527 of an ounce, Avoir.
1 ounce, Avoir. = 28.35 gram.	1 gram = .03215 of an ounce, Troy.
1 ounce, Troy = 31.104 grams.	1 gram = 15.432 grains, Troy.
1 lb. Avoir. = .4536 of a kilogram.	1 kilogram = 2.2046 pounds, Avoir.
1 lb. Troy = .3732 of a kilogram.	1 kilogram = 2.679 pounds, Troy.
1 ton (short) = .9072 of a tonneau.	1 tonneau = 1.1023 tons (short).

PROBLEMS

1. Reduce 763217 meters to kilometers.

2. Reduce 318.462 kilometers to meters.

3. Reduce 395.16 kilometers to centimeters.

4. Reduce 51626 centimeters to meters ; to kilometers.

5. If a man traveled 171 kilometers in a day, how many miles did he travel ?

6. If it cost $.22$\frac{1}{2}$ per meter for a fence, what will be the cost of a similar fence $\frac{3}{4}$ kilometers long ?

7. If it is 980 miles from New York to Chicago, how many kilometers is it; how many hectometers ?

8. 18.5 yards are how many meters ?

9. Write 6 meters, 3 decimeters and 5 centimeters as one number with the meter as the unit.

10. Express 19.763 m. in decimeters ; in centimeters.

11. In 5638 square meters how many ares; how many hectares?

12. In 218.75 hectares how many square meters; how many centares?

13. How many hectares in a farm 2.168 Km. long and 1.32 Km. wide?

14. What is the cost of a cement walk 5.64 m. long and $\frac{7}{8}$ m. wide at $2.60 per sq. m.?

15. A farm contains 192 hectares, if it is .376 Km. wide how long is it?

16. Express in hectares the equivalent of 247.1 acres.

17. Write as cubic meters 15 cubic decimeters, 4 cubic centimeters and 8 cubic millimeters.

18. Write the equivalent of these numbers in cubic decimeters: 14 cu. m., 18 cu. dm., 36 cu. cm.

19. A vessel is 1 m. long, $\frac{3}{4}$ m. wide and $1\frac{1}{3}$ m. high ; how many liters does it contain?

20. If a gallon of milk costs $.25 what should be the price per liter?

21. A bin contains 5689.35 hectoliters of wheat. What is it worth at $.32 per dekaliter?

22. A cistern 2.75 m. by 3.25 m. by 7.5 m. will hold how many dekaliters? How many cu. m.?

23. Write as liters in one number 3 l., 6 dl., 4 cl. and 5 ml.

24. How many grams in 1 Kilo.?

25. How many kilograms in 1 ton?

26. 5 Kilos. equal how many pounds?

27. 1 ton equals how many pounds av.?

28. How many powders of 7 grams each can be made from 637 kilograms?

29. How many sters in a pile of wood 1 m. wide, 3 m. long and $\frac{3}{4}$ m. high?

30. How many cubic meters in a box $\frac{3}{4}$ m. wide, $1\frac{1}{3}$ m. high and 3 m. long?

31. In 46328 cu. dm. how many cu. meters?

32. In 68.4 ares there are how many square meters?

VALUES OF FOREIGN COINS IN UNITED STATES MONEY

(Proclaimed by the Secretary of the Treasury, October 1, 1903)

COUNTRY.	Stand.	Monetary unit.	Value in terms of U. S. gold dollar.	Coins.
Argentine Rep.	Gold.....	Peso................	$0.965	Gold: argentine ($4.824) and ½ argentine. Silver: peso and divisions.
Aust.-Hungary	Gold.....	Crown..............	.203	{ Gold: former system—4 florins ($1.929), 8 florins ($3.858), ducat ($2.287) and 4 ducats ($9.149). Silver: 1 and 2 florins. Gold: present system—20 crowns ($4.052); 10 crowns ($2.026).
Belgium........	Gold.....	Franc..............	.193	Gold: 10 and 20 francs. Silver: 5 francs.
Bolivia	Silver...	Boliviano..........	.408	Silver: boliviano and divisions.
Brazil	Gold.....	Milreis.............	.546	Gold: 5, 10 and 20 milreis. Silver: ½, 1, and 2 milreis.
British Posses. N. A. (except Newf'nd)......	Gold.....	Dollar	1.000	
Cen. Am. St.— Costa Rica....	Gold.....	Colon...............	.465	Gold: 2, 5, 10 and 20 colons ($9.307). Silver: 5, 10, 25 and 50 centimos.
Brit Honduras	Gold.....	Dollar	1.000	
Guatemala .. } **Honduras** ... **Nicaragua** .. } **Salvador** .... }	Silver...	Peso................	.408	Silver: peso and divisions.
Chile............	Gold.....	Peso................	.365	Gold: escudo ($1.825), doubloon ($3.650), and condor ($7.300). Silver: peso and divisions.
China...........	Silver...	Tael. { Amoy	.659	
		Canton	.657	
		Chefoo......	.630	
		Chin Kiang.	.644	
		Fuchau	.610	
		Haikwan (Customs)	.671	
		Hankow....	.617	
		Hongkong..	(†)	
		Nanking....	.652	
		Niuchwang	.618	
		Ningpo	.634	
		Peking......	.643	
		Shanghai ..	.602	
		Swatow.....	.609	
		Takau......	.663	
		Tientsin ...	.639	[dor. Silver: peso.
Colombia.......	Silver...	Peso......	.408	Gold: condor ($9.647) and double-con-
Cuba............	Gold.....	Peso......	.926	Gold: Doubloon Isabella, centen ($5.017). Alphonse ($4.823). Silver: peso.
Denmark	Gold.....	Crown..............	.268	Gold: 10 and 20 crowns.
Ecuador	Gold.....	Sucre	.487	Gold: 10 sucres ($4.8665). Silver: sucre and divisions.
Egypt	Gold.....	Pound(100 piasters)	4.943	Gold: pound (100 piasters), 5, 10, 20 and 50 piasters. Silver: 1, 2, 5, 10 and 20 plasters. [($1.93).
Finland.........	Gold.....	Mark..............	.193	Gold: 20 marks ($3.859), 10 marks
France	Gold.....	Franc..............	.193	Gold: 5, 10, 20, 50 and 100 francs. Silver: 5 francs.
German Emp.	Gold.....	Mark....	.238	Gold: 5, 10 and 20 marks.
Great Britain.	Gold.....	Pound sterling.....	4.866½	Gold: sovereign (pound sterling) and ½ sovereign. [Silver: 5 drachmas.
Greece	Gold.....	Drachma............	.193	Gold: 5, 10, 20, 50 and 100 drachmas.
Haiti............	Gold.....	Gourde	.965	Gold: 1, 2, 5 and 10 gourdes. Silver: gourde and divisions.
India...........	Gold.....	Pound sterling‡....	4.866½	Gold: sovereign (pound sterling.) Silver: rupee and divisions. [5 lire.
Italy............	Gold.....	Lira	.193	Gold: 5, 10, 20, 50 and 100 lire. Silver:
Japan...........	Gold.....	Yen................	.498	Gold: 5, 10 and 20 yen. Silver: 10, 20 and 50 sen.
Liberia.........	Gold.....	Dollar	1.000	
Mexico	Silver...	Dollar	.443	Gold: dollar ($0.983), 2½, 5, 10 and 20 dollars. Silver: dollar (or peso) and divisions.

VALUES OF FOREIGN COINS IN U. S. MONEY — Continued

(Proclaimed by the Secretary of the Treasury, October 1, 1903)

COUNTRY.	Stand.	Monetary unit.	Value in terms of U. S. gold dollar.	Coins.
Netherlands...	Gold.....	Florin............ ..	$0.402	Gold: 10 florins. Silver: ⅒, 1 and 2½ florins.
Newfoundland	Gold.....	Dollar	1.014	Gold: 2 dollars ($2.027).
Norway........	Gold.....	Crown..............	.268	Gold: 10 and 20 crowns.
Persia..........	Silver....	Kran................	.075	Gold: ⅕, 1 and 2 tomans ($3.409). Silver: ⅛, ½, 1, 2 and 5 krans.
Peru............	Gold.....	Sol..................	.487	Gold: libra ($4.8665). Silver: sol and divisions.
Portugal	Gold.....	Milreis.............	1.080	Gold: 1, 2, 5 and 10 milreis.
Russia..........	Gold.....	Ruble..............	.515	Gold: imperial, 15 rubles ($7.718), and ½ imperial, 7½ r u b l e s ($3.859). Silver: ¼, ½ and 1 ruble.
Spain...........	Gold.....	Peseta.............	.193	Gold: 25 pesetas. Silver: 5 pesetas.
Sweden........	Gold.....	Crown..............	.268	Gold: 10 and 20 crowns.
Switzerland....	Gold.....	Franc..............	.193	Gold: 5, 10, 20, 50 and 100 francs. Silver: 5 francs.
Turkey	Gold.....	Piaster.............	.044	Gold: 25, 50, 100, 250 and 500 piasters.
Uruguay........	Gold.....	Peso................	1.034	Gold: peso. Silver: peso and divisions.
Venezuela......	Gold.....	Bolivar	.193	Gold: 5, 10, 20, 50 and 100 bolivars. Silver: 5 bolivars.

*The coins of silver-standard countries are valued by their pure silver contents, at the average market price of silver for the three months preceding the date of this circular.
†The "British dollar" has the same legal value as the Mexican dollar in Hongkong, the Straits Settlements, and Labuan.
‡The sovereign is the standard coin of India, but the rupee ($0.3244⅓) is the money of account, current at 15 to the sovereign.

STATUTORY WEIGHTS OF THE BUSHEL.

States and Territories.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Shelled corn.	Corn on cob.	Potatoes, Irish.	Onions.	Turnips, English.	Beans.	Apples.	Flaxseed.	Millet seed.	Timothy seed.	Clover seed.	Legislative Enactments.
United States	60	56	32	48	48	56		60			60		56				Act July 18, 1866. Tariff act, 1897.
Alabama	60	56	32	47		56	70	60		55	60						Act Feb. 18, 1891.
Alaska																	
Arizona	60	56	32	45		54					60						Comp. Laws, 1864-71.
Arkansas	60	56	32	48	52	56	70	60	57	57	60	50	56	50	60	60	Act Mar. 30, 1887.
California	60	54	32	50	40	52											Code and Stat., 1886.
Colorado	60	56	32	48	52	56	70	60	57		60				45	60	Gen. Stat., 1891.
Connecticut	60	56	32	48	48	56		60	52	50	60	48	55		45	60	Gen. Stat., 1902.
Delaware	60					56											Acts 1853, 1867, 1896.
Dist. of Columbia	60	56	32			56		60									Webb's Laws, 1868. U. S. Stat., 1896.
Florida	60	56	32	48		56	70	60	56	54	c60	48		50			Stat., 1901.
Georgia	60	56	32	47	52	56	70	60	57	55	60		56		45	60	Code, 1895.
Hawaii	60	56	32	48		56											Penal Laws, 1897.
Idaho	60	56	36	48	42	56		60				45	56			60	Laws, 1899-1903.
Illinois	60	56	32	48	52	56	70	60	57	55	60		56		45	60	Rev. Stat., 1899-1901.
Indiana	60	56	32	48	50	56	d68	60	48	55	60			50	45	60	Rev. Stat., 1897.
Indian Territory																	
Iowa	60	56	32	48	52	56	70	60	57		60	48	56	50	45	60	Rev. Code, 1897, and Laws, 1902.
Kansas	60	56	32	48	50	56	70	60	57	55	60	48	56	50	45	60	Gen. Stat., 1901.
Kentucky	60	56	32	47	56	56	e70	60	57	60	60		56	50	45	60	Gen. Stat., 1888.
Louisiana	60	f32	32	f32		56											Rev. Laws, 1884-1897.
Maine	60		30	48	48	56		60	52	50	60	44			45		Rev. Stat., 1883, Sup. 1895, Act, 1897.
Maryland			26					56									Code, 1888, and Sup. 1890-1900.
Massachusetts	60	56	32	48	48	56		60	52		60	48	55	g35	45	60	Rev. Laws, 1902.
Michigan	60	56	32	48	48	56	70	60	54	48	60	48	56	50	45	60	Com. Laws, 1897.
Minnesota	60	56	32	48	50	56	70	60	52	52	60	50		48	45	60	Rev. Stat. 1897.
Mississippi	60	56	32	48	48	56	72	60	57	55	60		56	50	45	60	Code, 1892, and Act Mar. 12, 1900.
Missouri	60	56	32	48	52	56	70	60	57	42	60	v48	56	50	45	60	Rev. Stat. 1899.
Montana	60	56	32	48	52	56	70	60	57		60	h45	56		45	60	Stat. 1888, 1901.
Nebraska	60	56	32	48	52	56	70	60	57	55	60		56	50	45	60	Com. Stat., 1901-1903.
Nevada																	
New Hampshire	60	56	32			56		60			62						Pub. Stat., 1901.
New Jersey	60	56	30	48	50	56		60	57		60	50	55			64	Gen. Stat., 1895.
New Mexico																	
New York	60	56	32	48	48	56		60	57		60	48	55		45	60	Gen. Laws, 1902.
North Carolina	60	56	32	48	50	56					60		55			60	Act, Jan. 31, 1885.
North Dakota	60	56	32	48	42	56	70	60	52	60	60		56	50	42	60	Code, 1899, and Act, Mar. 1901.
Ohio	60	56	32	48	50	56	68	60	55	60	60	50	56	50	45	60	Rev. Stat., 1902.
Oklahoma	60	56	32	48	42	56	70	60	52	60	60		56		42	60	Rev. Stat., 1903.
Oregon	60	56	32	46	42	56		60				45				60	Code, 1902.
Pennsylvania	60	56	32	47	48	56		56	50							60	Digest, 1700-1901.
Philippines																	Metric system.
Porto Rico																	Do.
Rhode Island	60	56	32	48	48	56	70	60	50	50	60	48	56	50	45	60	Pub. Laws, 1900.
Samoa																	English Weights and Measures. Laws of 1903.
South Carolina																	
South Dakota	60	56	32	48	42	56	70	60	52	60	60		56		42	60	Stat., 1901.
Tennessee	60	56	32	48	50	56	70	60	56	50	60	50	56	50	45	60	Act, 1887.

STATUTORY WEIGHTS OF THE BUSHEL—Continued.

States and Territories.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Shelled corn.	Corn on cob.	Potatoes, Irish.	Onions.	Turnips, English.	Beans.	Apples.	Flaxseed.	Millet seed.	Timothy seed.	Clover seed.	Legislative Enactments.
Texas	60	56	32	48	42	56	70	60	57	55	60	45	56	50	45	60	Act, Apr. 18, 1901.
Utah																	
Vermont	60	56	32	48	48	56		60	52	60	62	46			45	60	Stat., 1894.
Virginia	60	56	30	48	52	56	70	56	57	55	60	45	56	50	45	60	Code, 1887, and Act, Feb. 24, 1898.
Washington	60	56	32	48	42	56		60				45	56			60	Stat., 1897.
West Virginia	60	56	32	48	52	56		60			60		56		45	60	Code, 1899.
Wisconsin	60	56	32	48	50	56	70	60	57	42	60	50	56	50	45	60	Stat., 1898, and Act, Mar. 30, 1901.
Wyoming																	

c Velvet beans in hull, 78.
d Before Dec. 1, 70.
e May 1 to Nov. 1, 68.

f So in statutes, but an evident error.
g Japanese barnyard millet.
h Peeled, 40.

ANSWERS

ADDITION

Article 34.

2. 889.
3. 698.
4. 967.
5. 898.
6. 6546.
7. 786.
8. 766.
9. 9657.
10. $583.

Article 35.

2. 186.
3. 1492.
4. 2715.
5. 9767.

6. 13054.
7. 17059.
8. 3127.
9. 31945.
10. 122223.
11. 469294.
12. 2601786.
13. 15448707.
14. 2134.
15. 11932.
16. 149271.
17. $3162.
18. $21367.
19. 32515 ft.
20. 77604.
21. 504689.

22. $15667.
23. 10060 lbs.
24. $15762.
25. $641.
26. $9079.
27. $5285.
28. 4305 bu.
29. 4619.
30. 4915.
31. 4320.
32. 4623.
33. 3871.
34. 39267.
35. $11024.
36. $8304.
37. $435.

38. $22290.
39. 695 head.
   $5698.
40. $5155.
41. $196910.
42. 40000.
43. 26520.
44. 23029.
45. 176597.
46. 1106771.
47. 1349248.
48. 18366751.
49. 15971078.
50. 7556628.
51. 4187383.

SUBTRACTION

Article 41.

2. 32.
3. 72.
4. 55.
5. 542.
6. 261.
7. 712.
8. $232.
9. $235.
9. $2855.
1. 2307 bu.

12. 62114 bricks.
13. 50435 yds.

Article 42.

2. 335.
3. 2561.
4. 561.
5. 3769.
6. 269.
7. 4509.
8. 1288.
9. 30616.

10. 21078.
11. 142.
12. 762301.
13. 138.
14. 4786.
15. 36824.
16. 22988.
17. 89093.
18. 296853.
19. 15744.
20. 4373.
21. 988606.

22. 1902001.
23. $1482.
24. $5457.
25. $4251.
26. $4315.
27. $9860.
28. $4644.
29. $2948.
30. $1288.
31. 1250.
32. $1316.
33. $683.65.
34. $498.30.
35. $23107.02.

MULTIPLICATION

Article 43.

2. 3248.
3. 7308.
4. 7348.
5. 16310.
6. 50550.
7. 20909.

8. 25632.
9. 41616.
10. 13140.
11. 27738.
12. 42115.
13. 44289.
14. 25374.

15. 131235.
16. 327872.
17. 163215.
18. 194076.
19. 348096.
20. 222848.
21. 348921.

22. 10588 gal.
23. $13225.
24. $1911.
25. $2072.
26. $32778.
27. 768 mi.
28. $261051.

Article 49.
2. 17155.
3. 16668.
4. 13936.
5. 54128.
6. 113542.
7. 1067616.
8. 15824.
9. 1007616.
10. 407000.
11. 5460200.
12. 5031110.
13. 5254000.
14. 10800000.
15. 17313936.
16. $171784.
17. $208656.
18. $51121.
19. 792000.
20. 8820000.
21. $34692.
22. $153832.
23. 152000 lbs.
24. 53640 lbs.
25. $16560.
26. 205821 gal.
27. 545622 cu. in.
28. 52752 lbs.
29. 208250 cents.
30. 7878000 steps.
31. 770400 words.
32. 846720 lbs.
33. 2016000 cents.

Addition, Subtraction and Multiplication

Article 50.
1. 38400 cents.
2. $595.
3. $344.
4. $102.
5. $2865.
6. B, $600.
7. $171.
8. $27.
9. $261.
10. 1296 miles.
11. $200 gain.
12. $7700.
13. $11960.
14. $310.
15. $5025.

DIVISION

Article 56.
2. 432.
3. 312.
4. 110.
5. 3124.
6. 3212.
7. 1221.
8. 4312.
9. 3102.
10. 20120.
11. 10203.
12. 10420.
13. 1011.
15. 430.
16. 735.
17. 832.
18. 382.
19. 1162.
20. 1324.
21. 1214.
22. 420.
23. 2853.
24. 4754.
25. 16227.

Article 57.
2. 213.
3. 34.
4. 67.
5. 247.
6. 314.
7. 48.
8. 135.
9. 344.
10. 212, Rem. 92.
11. 958.
12. 7198.
13. 1489, Rem. 33.
14. 329916.
15. 14142.
16. 12152, Rem. 9.
17. 1444.
18. 8862.
19. $463\frac{53}{64}$.
20. 329.
21. $479\frac{67}{267}$.
22. $535\frac{13}{48}$.
23. 128.
24. $108.
25. $96.
26. $43\frac{176}{228}$.
27. $176.

Article 58.
2. 6034, Rem. 36.
3. 25.
4. 19, Rem. 20.
5. 15, Rem. 65.
6. 478.
7. 75, Rem. 550.
8. 469,
   Rem. 1470.
9. 350.
10. 1285,
   Rem. 2080.
11. 75.
12. $240.

Addition, Subtraction, Multiplication and Division

Article 59.
1. $154.
2. $981.
3. 12.
4. 390.
5. $712.
6. $336.
7. 240.
8. $120.
9. $2904.
10. 516.
11. $18394.
12. $2953.
13. 12.
14. 80.
15. $8.
16. $3468.
17. Daughter $12923; each son $13763.
18. B, $4200; C, $15780; all $20940.
19. Gained $13.
20. 20 yrs.
21. $9150.
22. $4.
23. Grocer owed farmer 12 cts.
24. 15 cents.
25. 45 yards.
26. 2474.
27. $1490.
28. $8269.
29. $10185.
30. 450 sheep. $5050.

FACTORING

Article 67.
2. 3, 3.
3. 2, 2, 3.
4. 3, 2, 3.
5. 3, 3, 2, 2.
6. 5, 7.
7. 2, 3, 7.
8. 2, 5, 5.
9. 3, 2, 11.
10. 2, 2, 2, 2, 2, 3.
11. 2, 2, 3, 3, 3.
12. 2, 2, 2, 3, 5.
13. 2, 2, 31.
14. 2, 3, 31.
15. 5, 5, 3, 3.
16. 3, 7, 11.
17. 2, 2, 2, 2, 2, 3, 3.
18. 2, 3, 7, 7.
19. 3, 3, 3, 11.

20. 2, 2, 3, 5, 5. *25.* 2, 2, 2, 2, 41. *30.* 2, 3, 3, 7, 23. *34.* 2, **2**, 11, 79.
21. 5, 7, 11. *26.* 2, 2, 3, 3, 3, 7. *31.* 2, 2, 29, 37. *35.* 2, 5, 17, 31.
22. 3, 5, 31. *27.* 19, 67. *32.* 3, 2, 29, 53. *36.* 2, 2, 3, 19, 3, 13.
23. 3, 5, 5, 7. *28.* 2, 2, 2, 5, 73. *33.* 3, 11, 13, 19. *37.* 11, 29, 43.
24. 2, 2, 7, 23. *29.* 3, 449.

CANCELLATION

Article 70.   *5.* 54.   *9.* 49.   *12.* 60.
2. 11.   *6.* 21.   *10.* \$76.   *13.* \$2.
3. 16.   *7.* 48.   *11.* 24.   *14.* 96.
4. 24.   *8.* 16⅕.

GREATEST COMMON DIVISOR

Article 72.   *4.* 14.   *7.* 6.   *10.* 14.
2. 19.   *5.* 19.   *8.* 56.   *11.* 60.
3. 4.   *6.* 13.   *9.* 4.

LEAST COMMON MULTIPLE

Article 76.   *5.* 1260.   *8.* 8400.   *11.* 300.
2. 2835.   *6.* 288.   *9.* 224.   *12.* 90.
3. 5040.   *7.* 2520.   *10.* 240.   *13.* 378.
4. 960.

FRACTIONS

Article 93.
2. $\frac{4}{5}$, $\frac{17}{22}$, $\frac{15}{16}$, $\frac{9}{20}$.
3. $\frac{2}{5}$, $\frac{13}{19}$, $\frac{8}{25}$, $\frac{9}{84}$, $\frac{3}{7}$, $\frac{11}{68}$.
4. $\frac{1}{5}$.
5. $\frac{1}{16}$.
6. $\frac{9}{85}$.
7. $\frac{17}{23}$.

Article 94.
2. $\frac{6}{15}$.
3. $\frac{20}{35}$.
4. $\frac{32}{63}$.
5. $\frac{96}{180}$.
6. $\frac{120}{108}$.
7. $\frac{450}{375}$.
8. $\frac{600}{896}$.
9. $\frac{600}{918}$.
10. $\frac{1744}{2840}$.

Article 95.
2. 4.
3. 8$\frac{2}{7}$.
4. 23$\frac{2}{7}$.

5. 21.
6. 22.
7. 15$\frac{3}{7}$.
8. 41$\frac{1}{7}$.
9. 36$\frac{3}{13}$.
10. 7$\frac{4}{17}$.
11. 41$\frac{1}{4}$.
12. 83$\frac{3}{7}$.
13. 347$\frac{1}{4}$.
14. 72$\frac{4}{5}$.
15. 188$\frac{2}{3}$.
16. 37.

Article 96.
2. $\frac{45}{8}$.
3. $\frac{230}{5}$.
4. $\frac{534}{6}$.
5. $\frac{420}{15}$.
6. $\frac{900}{25}$.
7. $\frac{1350}{30}$.
8. $\frac{3680}{40}$.
9. $\frac{6912}{64}$.

10. $\frac{16840}{76}$.
11. $\frac{36}{1}$.
12. 17$\frac{1}{5}$.
13. $\frac{2560}{8}$.
14. $\frac{13864}{24}$.
15. $\frac{647}{17}$.
16. $\frac{11}{3}$.
17. $\frac{95}{1}$.
18. $\frac{743}{9}$.
19. $\frac{55}{6}$.
20. $\frac{525}{8}$.
21. $\frac{303}{16}$.
22. $\frac{680}{29}$.
23. 7$\frac{27}{41}$.
24. $\frac{11862}{11}$.
25. $\frac{17801}{15}$.
26. $\frac{94819}{41}$.

Article 97.
2. $\frac{8}{24}$, $\frac{20}{24}$, $\frac{21}{24}$.
3. $\frac{16}{40}$, $\frac{25}{40}$, $\frac{28}{40}$.
4. $\frac{49}{70}$, $\frac{42}{70}$, $\frac{35}{70}$, $\frac{22}{70}$.

5. $\frac{33}{36}$, $\frac{32}{36}$, $\frac{22}{36}$, $\frac{17}{36}$.
6. $\frac{6}{24}$, $\frac{6}{24}$, $\frac{4}{24}$, $\frac{3}{24}$, $\frac{2}{24}$.
7. $\frac{72}{120}$, $\frac{15}{120}$, $\frac{36}{120}$, $\frac{56}{120}$, $\frac{102}{120}$.
8. $\frac{2160}{2520}$, $\frac{2805}{2520}$, $\frac{2240}{2520}$, $\frac{2268}{2520}$, $\frac{2310}{2520}$, $\frac{2520}{2520}$.
9. $\frac{576}{720}$, $\frac{600}{720}$, $\frac{630}{720}$, $\frac{420}{720}$, $\frac{405}{720}$, $\frac{700}{720}$.
10. $\frac{36}{45}$, $\frac{41}{45}$, $\frac{-165}{45}$, $\frac{-405}{45}$, $\frac{35}{45}$.
11. $\frac{42}{56}$, $\frac{104}{56}$, $\frac{49}{56}$, $\frac{44}{56}$, $\frac{330}{56}$.
12. $\frac{180}{300}$, $\frac{210}{300}$, $\frac{160}{300}$, $\frac{135}{300}$, $\frac{144}{300}$, $\frac{330}{300}$.
13. $\frac{40}{120}$, $\frac{45}{120}$, $\frac{96}{120}$, $\frac{56}{120}$.
14. $\frac{72}{144}$, $\frac{108}{144}$, $\frac{120}{144}$, $\frac{126}{144}$, $\frac{132}{144}$, $\frac{125}{144}$, $\frac{136}{144}$.
15. $\frac{7}{20}$, $\frac{125}{20}$, $\frac{18}{20}$, $\frac{140}{20}$, $\frac{12}{20}$, $\frac{11}{20}$.

Addition of Fractions

Article 98.

2. $2\frac{1}{4}$.
3. $\frac{4}{5}$.
4. $1\frac{37}{40}$.
5. $\frac{19}{20}$.
6. $3\frac{1}{24}$.
7. $2\frac{73}{84}$.
8. $38\frac{5}{6}$.
9. $32\frac{47}{72}$.
10. $25\frac{67}{140}$.
11. $73\frac{1}{24}$.
12. $18\frac{65}{68}$.
13. $\frac{63}{64}$.
14. $478\frac{5}{21}$.
15. $27\frac{85}{96}$.
16. $69\frac{39}{40}$.
17. $19\frac{3}{10}$.
18. $248\frac{3}{4}$.
19. $4\frac{131}{180}$.
20. $165\frac{12}{20}$.
21. $5208\frac{1}{18}$.
22. $248\frac{11}{12}$.
23. $371\frac{7}{8}$.
24. $12864\frac{43}{560}$.
25. $41\frac{37}{40}$.
26. $1856\frac{5}{64}$ bu. $776\frac{7}{8}$.
27. $179\frac{1}{2}$.
28. $996\frac{1}{2}$.

Subtraction of Fractions

Article 99.

2. $\frac{1}{2}$.
3. $\frac{6}{11}$.
4. $\frac{1}{4}$.
5. $\frac{53}{80}$.
6. $\frac{17}{120}$.
7. $3\frac{13}{16}$.
8. $13\frac{11}{16}$.
9. $4\frac{13}{18}$.
10. $3\frac{13}{16}$.
11. $10\frac{1}{3}$.
12. $154\frac{13}{20}$.
13. $3\frac{83}{85}$.
14. $\frac{1}{4}$.
15. $\frac{9}{20}$.
16. $10\frac{103}{110}$.
17. $2\frac{27}{34}$.
18. $3\frac{1}{8}$.
19. $4\frac{4}{5}$.
20. $4\frac{11}{20}$.
21. $46\frac{2}{24}$.
22. $40\frac{2}{5}$.
23. $1118\frac{13}{40}$.
24. $\frac{5}{6}$.
25. $19\frac{17}{20}$.
26. $56\frac{85}{104}$.
27. $70\frac{197}{240}$.
28. $166\frac{7}{75}$.
29. $24\frac{1}{8}$.
30. $373\frac{1}{16}$.

Multiplication of Fractions

Article 102.

2. $2\frac{1}{2}$.
3. $3\frac{3}{4}$.
4. $3\frac{5}{8}$.
5. $2\frac{1}{8}$.
6. $3\frac{1}{8}$.
7. $7\frac{5}{7}$.
8. $1\frac{6}{7}$.
9. 7.
10. $3\frac{28}{45}$.
11. $5\frac{11}{15}$.
12. $67\frac{1}{2}$.
14. $2840\frac{5}{6}$.
15. $3853\frac{3}{4}$.
16. $1127\frac{7}{8}$.
17. $7\frac{1}{2}$.
18. $51\frac{1}{16}$.
19. $5\frac{1}{8}$.
20. $176\frac{1}{4}$.

Article 103.

2. $1\frac{1}{8}$.

3. 12.
4. 36.
5. $86\frac{2}{3}$.
6. 85.
7. $56\frac{1}{16}$.
8. 6.
10. 455.
11. $864\frac{1}{2}$.
12. 3570.
13. $10959\frac{29}{58}$.
14. 108.
15. 567.
16. $1545\frac{5}{8}$.
17. $1388\frac{1}{4}$.
18. $51\frac{4}{5}$.

Article 104.

2. $\frac{1}{8}$.
3. $\frac{7}{10}$.
4. $\frac{3}{10}$.
5. $3\frac{2}{3}$.
6. $51\frac{2}{5}$.

7. $647\frac{83}{70}$.
8. $33\frac{11}{120}$.
9. $193\frac{18}{28}$.
10. $\frac{55}{156}$.
11. $59\frac{3}{4}$.
12. $1\frac{9}{26}$.
13. $1077\frac{3}{10}$.
14. $\frac{1}{2}$.
15. $47\frac{7}{48}$.
16. 1792.
17. $\frac{3}{46}$.
18. $\frac{440}{457}$.
19. $\frac{5}{8}$.
20. $\frac{7}{12}$.
21. $\frac{5}{8}$.
22. 128.
23. 72.
24. $1\frac{1}{2}$.
25. 108.
26. $\frac{24}{25}$.
27. $267\frac{3}{18}$.

28. $7\frac{1}{3}$.
29. $233\frac{1}{8}$.
30. $5\frac{9}{160}$.
31. $3\frac{1}{5}$.
33. $253\frac{22}{48}$.
34. $834\frac{9}{25}$.
35. $1105\frac{24}{25}$.
36. $10\frac{13}{16}$.
37. $54\frac{1}{20}$.
38. $703\frac{101}{121}$ cts.
39. $75333\frac{1}{8}$ cts.
40. $104\frac{43}{48}$.
41. $1097\frac{1}{16}$.
42. 1080.
43. 74214 cts.
44. $121\frac{3}{25}$.
45. $308\frac{3}{4}$ cts.
46. $502\frac{3}{4}$ cts.
47. $1728\frac{12}{48}$ cts.
48. $1\frac{5}{16}$.
49. $21\frac{733}{2970}$ gain.

Division of Fractions

Article 106.

2. $\frac{2}{5}$.
3. $\frac{3}{17}$.
4. $\frac{5}{87}$.
5. $\frac{3}{87}$.
6. $\frac{3}{125}$.
7. $\frac{17}{253}$.
8. $\frac{1}{166}$.

9. $\frac{2}{228}$.
10. $\frac{7}{48}$.
11. $\frac{2}{11}$.
12. $\frac{1}{12}$.
13. $\frac{27}{28}$.
14. $3\frac{2}{25}$.
15. $140\frac{19}{20}$.
16. $\frac{17}{86}$.

Article 109.

2. $1\frac{1}{4}$.
3. $1\frac{5}{16}$.
4. $5\frac{7}{8}$.
5. $1\frac{3}{14}$.
6. $\frac{69}{81}$.
7. $1\frac{1}{2}$.
8. $1\frac{1}{24}$.

9. $7\frac{1}{2}$.
10. $5\frac{9}{22}$.
11. $74\frac{4}{5}$.
12. $5\frac{1}{8}$.
13. $2\frac{5}{7}$.
14. $\frac{3}{8}$.
15. $5\frac{43}{64}$.
16. $\frac{63}{72}$.

17. $\frac{21}{180}$.
18. $\frac{8}{27}$.
20. $1\frac{1}{5}$.
21. $\frac{888}{855}$.
22. $\frac{45}{704}$.
23. $\frac{71}{112}$.
24. $1\frac{5}{36}$.
25. $\frac{3}{8}$.
26. $\frac{40}{189}$.
27. $2\frac{1}{2}$.
28. $1\frac{1}{2}$.
29. $1\frac{34}{146}$.
30. $\$4\frac{1}{4}$.
31. 10.
32. 6.
33. 9.
34. $8.
36. $30.
37. $40.

Article 110.

1. $\frac{7}{8}$.

2. $1\frac{3}{4}$.
3. $\frac{2999}{7}$.
4. $83\frac{3}{16}$.
5. $\frac{78}{120}$, $\frac{30}{120}$, $\frac{75}{120}$, $\frac{80}{120}$.
6. $5\frac{1}{5}$.
7. $55\frac{14}{30}$.
8. $2\frac{1}{24}$.
9. $2\frac{9}{140}$.
10. $422\frac{6}{70}$.
11. $2\frac{12}{85}$.
12. $14\frac{10}{21}$.
13. $27\frac{99}{184}$.
14. $\$46\frac{7}{8}$.
15. $30\frac{163}{26}$.
16. 10.
17. $70.
18. 24.
19. $47\frac{483}{1084}$.
20. $\$2\frac{1}{4}$.
21. $32.
22. $\$136\frac{1}{4}$.

23. $1\frac{7}{8}$ yds.
24. $\frac{4}{5}$.
25. $2\frac{1}{4}$.
26. $\$87\frac{1}{2}$.
27. $\$8\frac{1}{2}$.
28. 300.
29. $646.
30. 180.
31. 9.
32. 192.
33. $\$5090\frac{10}{11}$.
34. $\$13\frac{5}{8}$.
35. $\$\frac{5}{8}$.
36. 334.
37. $\$3\frac{17}{19}$.
38. A 168, B 112.
39. $\$7\frac{4}{5}$.
40. $3.
41. $\$472\frac{19}{200}$.
42. 40.
43. A $208, B $156.
44. $2\frac{3}{4}$.

45. Cost 683\frac{1}{8}$, sold 802\frac{7}{8}{240}$, gain 119\frac{6}{48}$.
46. 4 days.
47. $\$4577\frac{3}{80}$.
48. 36 ft.
49. A 360, B 320.
50. $5800, $1305.
51. $8\frac{4}{7}$.
52. 12 da.
53. A $2310, B $2800, C $1050.
54. $150, $90.
55. Lost $2.
56. Buggy $80, horse $100.
57. A's $96, B's $120, C's $144, D's $90.
58. $9\frac{1}{8}$.
59. A 440, B 352.
60. $\$21114\frac{1}{2}{32}$.

Decimal Fractions

Article 117.

2. .6.
3. .625.
4. .875.
5. .9375.
6. .208$\frac{1}{3}$.
7. .325.
8. .053$\frac{3}{4}$.
9. .107$\frac{1}{7}$.
10. .072$\frac{6}{8}$.
11. .008.
12. .00375.
13. 12.375.
14. 42.1875.
15. 200.015.

Article 118.

2. $\frac{1}{2}$.
3. $\frac{9}{20}$.
4. $\frac{1}{8}$.
5. $\frac{3}{8}$.
6. $\frac{2}{125}$.
7. $\frac{3}{40}$.
8. $\frac{5}{8}$.
9. $1\frac{5}{16}$.
10. $\frac{1}{1250}$.
11. $28\frac{1}{16}$.
12. $136\frac{1}{200}$.
13. $\frac{4}{5}$.
14. $\frac{1}{7}$.
15. $\frac{1}{12}$.

16. $\frac{3}{580}$.
17. $107\frac{1}{8}$.
18. $8\frac{863}{7000}$.
19. $16\frac{9}{600}$.
20. $143\frac{178}{125}$.

Article 119.

2. 1.4697.
3. 1.527.
4. 12.4203.
5. 45.5345.
6. $23.86.
7. 448.335.
8. 1465.856.
9. 9468.5566.

10. 1291.5154.
11. 7590.153.
12. 5038.4514.
13. 37.047.
14. 197.79985.
15. 87.0885.
16. $25.059.
17. $1541.86.
18. 93.6375.
19. 921.3087.
20. 22.5625 yds. $13.8625.
21. 5407.06444.
22. 10756.78876.

Subtraction of Decimals

Article 120.

2. .2551.
3. .3844.
4. 10.1586.
5. 7.6719.
6. $13.075.

7. 128.615.
8. 194.567.
9. 8093.9282.
10. 77.779.
11. 114.144.

12. $27.33.
13. $1717.916.
14. 16.0838.
15. 8.9991.
16. 43.1875.

17. 824.175.
18. 11.0408.
19. 106.18125.
20. 28.375875.
21. 75.825753.

Multiplication of Decimals

Article 121.

2. 19.27206.
3. .2674968.
4. 92.752.

5. 312.1065.
6. 4.687225.
7. 20.788302.
8. 1031.921605.

9. 3787.8025.
10. .049.
11. 21.025.
12. .0001495.

13. 1.
14. $111.24375.
15. 1.63215.
16. $52.46875.

Division of Decimals

Article 122.
2. 4.5.
3. $4.6.
4. 7.8 feet.
5. 23.5.
6. .084.
7. .215.
8. 8300.
9. 480.
10. 18600.
11. 425.
12. 2.7.
13. 21500.
14. 15.278+.
15. .02.
16. 1450 bushels.
17. 32 machines.
18. 6350.
19. 172300.
20. 3020.

Review Problems

Article 123.
1. 122.099645.
2. 6188.311478.
3. 573 acres.
4. $1680.
5. $524.04.
6. 124.9875.
7. 999999.999999.
8. .09775.
9. 720.352035.
10. $137.32005.
11. .00034375.
12. 7.
13. 341.45.
14. 107 barrels.
15. $\frac{7}{8}$.
16. 146$\frac{1}{6}$.
17. .012.
18. .65013054+.
19. 203.29\frac{11}{4}$.
20. 3.461+ or 3$\frac{6}{18}$.

UNITED STATES MONEY

Addition

Article 133.
2. $940.785.
3. $134.93.
4. $523.03.
5. $31.135.
6. $2835.185.
7. $4182.52.
8. $442.35.
9. $8426.48.
10. $11.
11. $282.75.
12. $207.675.
13. $100.65.

Subtraction

Article 134.
2. $111.88.
3. $83.749.
4. $999.989.
5. $168.087.
6. $576.56.
7. $2951.06.
8. $50.90.
9. $764.
10. $672.65 loss.
11. $2.42.

Multiplication

Article 135.
2. $182.25.
3. $582.25.
4. $7240.
5. $14.87.
6. $444.70.
7. 1891.77\frac{1}{2}$.
8. $64.375 gain.

Division

Article 136.
2. $.56.
3. $45.
4. 3.87\frac{1}{2}$.
5. $.32.
6. 475 barrels.
7. $72.
8. 56.37\frac{1}{2}$.
9. $.13.
10. 124$\frac{7}{17}$ bushels.
11. $.872$\frac{43}{72}$.
12. $.27.
13. $.75.
14. $.22$\frac{1}{2}$.

SHORT METHODS

Article 138.
2. $109.
3. $156.
4. $156.25.
5. $94.
6. 2236.66\frac{2}{3}$.
7. 152.18\frac{3}{4}$.
8. $97.20.
9. 10.72\frac{1}{2}$.
10. 4413.33\frac{1}{8}$.

Article 139.
2. 53 lbs.
3. 192.9 doz.
4. 50$\frac{5}{8}$ bushels.
5. 210 lbs.
6. 72.5 acres.
7. 309$\frac{3}{4}$ acres.
8. 1495 lbs.
Article 140.
2. $75.67.

3. $226.151.
4. 101.36\frac{3}{4}$.
5. $48.692.
6. $41.782.
7. 56.87\frac{1}{2}$.
8. $44.16.
9. 61.50\frac{1}{4}$.
10. $24.22405.
11. $47.8486.

Article 141.
2. $58.6635.
3. 5.26\frac{1}{4}$.
4. $2.738125.
5. $10.2648.
6. $1048.58325.
7. $377.806.
8. 141.01\frac{1}{4}$.
9. $99.36.
10. 52.93\frac{1}{4}$.

BILLS

Article 145.

1. $438.14.
2. $16.73.
3. $53.81.
4. $59.06.
5. $906.81.
6. $65.02.
7. $123.28.
8. $7.04½ amt.
9. $18.01⅛ amt.
10. $89.20 amt.
11. $186.7985 amt.
12. $40.71 amt.
13. $226.09.
14. $258.57 3/16.
15. $195.49.
16. $177.28.

Review Problems

Article 146.

1. $623.37¼.
2. $406.
3. $45.25.
4. $841.48.
5. $2679.60.
6. $220.20.
7. $.33½.
8. $10.33½.
9. $12. gain.
10. $10.17.
11. $127.80.
12. $358.40.
13. $39.12¼.
14. $330.75.
15. $3066.82.
16. $806.25.
17. $1701.
18. $.55.
19. $26.75.
20. 187 head.
21. $1.
22. $5333¼.
23. $73.45.
24. $292.16¾.
25. $3.24 loss.
26. $69.91½.
27. $20.12½.
28. .5.
29. $29.5974.
30. 45 minutes.
31. 1/16.
32. $81.872.
33. $4.94⅜.
34. 1.464375.
35. $62.83½ gain.
36. 174.8952 gal.
37. $42880.
38. {
$49560. sales of matting.
$214760. sales of carpeting.
$161070. cost of carpeting.
$25167.18¾ expenses.
}

REDUCTION OF DENOMINATE NUMBERS

Article 155.

3. 22547 far.
4. £32 15s. 8d.
5. 10058 far.
6. 253 far.
7. £18 11s. 11d.
8. 79971 far.
9. £6 15s. 4d.
10. 342720d.

Avoirdupois Weight

Article 160.

1. 302 lbs.
2. 4500 lbs.
3. 8253 oz.
4. 54787 dr.
5. 1719998 dr.
6. 43 cwt. 7 lbs.
7. 6 T. 6 cwt.
8. 4 T.
9. 2 cwt. 52 lbs. 2 oz. 2 dr.
10. 1 T. 1 cwt. 26 lbs. 1 oz.
11. $1061.04.
12. $94.01.
13. $9.55⅝.
14. $15.
15. 24 T. 10 cwt.
16. $2.55.
17. $39.09⅜.
18. $49.21⅞.
19. $297.45.
20. $166.91¼.

Troy Weight

Article 161.

1. 23040 gr.
2. 835 pwt.
3. 79606 gr.
4. 6 pwt. 2 gr.
5. 5 lb. 7 oz. 19 pwt. 9 gr.
6. $54.20.
7. $2549.40.
8. $62.50.
9. 14 oz.
10. $14 1/16.

Apothecaries' Weight

Article 162.

1. gr. 28800.
2. Ʒ 3171.
3. gr. 12642.
4. 4 ℔.
5. ℥8 Ʒ1 gr. 4.
6. 4 ℔. ℥6 Ʒ1 gr. 1.
7. 471.
8. 10 ℔. ʒ1 Ʒ5 Ʒ1.
9. $68.40.
10. $218.
11. $4212.

Comparison of Weights

Article 164.

1. 21₁⁷₇₅ lbs.
2. $1667.50.
3. 92 lbs. 4 oz. 6
pwt. 16 gr.

4. 78 lb. 11 oz. 18
pwt. 8 gr.
5. $12.
6. 266₁⁹⁹₇₅ oz.

7. $92.
8. 82⅔ oz.
9. 43¾ lb.
10. $22⅞.

11. 12 lb. 10₁⁷₁₂ oz.
12. 26 lb. 4₁³⁹₇₅ oz.
13. Yes.   1240
Troy grains.

Long Measure

Article 168.

1. 103 in.
2. 260 in.
3. 1600 rds.
4. 2785 rds.

5. 5145 rds.
6. 3657 in.
7. 1 fur. 24 rds. 2
yds. 1 ft. 4 in.

8. 14 mi. 7 fur. 26
rds. 3 yds. 2 ft.
9. $500.90⅝.
10. 2230 in.
11. 240 leagues.

12. $23.80.
13. $369.90.
14. 65 in.
15. 2213.12 mi.
16. 8700.

Surveyors' Long Measure

Article 169.

1. 17772.48 in.
2. 182239.2 in.

3. 6600 ft.
4. 7832 yds.

5. 2 mi. 3 ch. 3
rd. 9 l.

6. 10208.88 ft.

Square Measure

Article 172.

1. 7776 sq. in.
2. 1600 sq. rd.
3. 102400 sq. rd.
4. 3312 sq. in.
5. 241128½ sq. ft.
6. 412247748 sq.
in.
7. 6 A.

8. 1 sq. yd. 8 sq.
ft. 19 sq. in.
9. 3 sq. yd. 2 sq.
ft. 2 sq. in.
10. 12 sq. yd. 5 sq.
ft. 56 sq. in.
11. 49 sq. ft.
12. 75 A.
13. 600 sq. yd.
14. 54 sq. yd.

15. $6.21.
16. $234.60.
17. $27.12.
18. 1004 sq. ft.
19. $186.14.
20. $100.67.
21. $163⅞.
22. $602.25.
23. 51¼ yd.
24. $56.

25. $151.80.
26. $96.07.
27. $252.
28. $63.22.
29. $13.44.
30. $49.18.
31. 426 ft.
32. 27 ft.
33. 5964¾ sq. ft.
34. 6400 sq. ft.

Board Measure

Article 175.

1. 16 ft.
2. 18 ft.
3. 42 ft.

4. 250 ft.
5. 72 ft.
6. 138⅔ ft.
7. 1306¾ ft.

8. 1620 ft.
9. 378 ft.
10. $11.52.

11. $12.83.
12. $25.03.
13. 184.96.

Surveyors' Square Measure

Article 181.

1. 23040 A.
2. 3880240 sq. l.

3. 65 A. 2 sq. ch.
5000 sq. l.
4. $5579.76.
5. $3500.

7. $332.
8. $11180.
$1128.60.
9. 400 A.

10. 360 A.
11. 9½⁸₀.
$621.18.

Cubic Measure

Article 184.

1. 147 cu. ft.
2. 30C. 24 cu. ft.
3. 78 cu. ft.
4. 466⅔ cu. yd.

5. 128 cu. yd.
6. 5C. 32 cu. ft.
7. $11.14.
8. 15C.
9. 125 cu. ft.

10. $41.07.
11. 128 ft.
12. 1 hr. 48 min.
13. $50.91.

14. $25.60.
15. 1520 cu. ft.,
33440 brick,
$284.24.

Liquid Measure

Article 187.
1. 104 pt.
2. 69 pt.
3. 10080 gi.
4. 191 gi.
5. 633 pt.

6. 158 gal. 3 qt.
7. 54 bbl. 14 gal.
   2 qt. 1 pt.
8. 317 bbl. 14 gal.
   2 qt.

9. $362.88.
10. $14.49.
11. 44.
12. 14553 cu. in.
13. $20\frac{4}{77}$ gal.

14. $1436\frac{49}{77}$ gal.
15. $935\frac{5}{77}$ gal.
16. $718\frac{19}{49}$ gal.
17. $329\frac{1}{4}$ gal.

Apothecaries' Fluid Measure

Article 188.
1. f℥ 48.

2. fℨ 736.
3. fℨ 1997.

4. M 223182.
5. f℥ 2 fℨ 6 M 28.

6. Cong. 2 O2 fℨ
  9 fℨ 5.

Dry Measure

Article 189.
1. 128 pt.
2. 368 pt.
3. 164 pt.
4. 511 pt.
5. 6 bu.

6. 2 pk. 7 qt. 1 pt.
7. 44 bu. 3 pk. 1
  pt.
8. 767 pt.
9. $3.20.
10. $9.12.
11. $1.90.

12. $1.56.
13. $2.16.
14. $2.05, 6 cts.
15. 36557.14 cu.
  in.
16. $7\frac{1}{4}$ bu.

17. $2256\frac{3}{4}$ bu.
  nearly.
18. $137.85.
19. $108.
20. 19 ft. 5.3 + in.
21. $34.65.
22. 9 ft. 11.46 + in.

Comparison of Dry and Liquid Measure

Article 191.
1. 27 gal. 1 qt. +
2. 5 bu. 2 pk. 1
  qt. 2 pt. —

3. Paid
  $2.92, gain
  $.90.
4. $1.63.

5. The latter,
  $.61.
6. 302.4 cu. in

Time Measure

Article 194.
1. 7200 sec.
2. 7680 min.
3. 200732 sec.
4. 12547638 sec.

5. 98845 min.
6. 164392938 sec.
7. 4 hr. 3 min.
  20 sec.
8. 2 wk. 4 da. 7 hr. 5 min.

9. 1 mo. 1 da. 1
  min.
10. 5 mo. 6 da. 19
  hr. 28 min. 20
  sec.

11. 105.
12. 88.
13. 198.
14. 91.

Circular Measure

Article 196.
1. 15336''.
2. 136132''.

3. 3° 25' 46''.
4. 120°.
5. 95°.

6. 10800'.
7. $12448\frac{4}{5}$ stat.
  mi.

8. $315\frac{7}{15}$ geog.
  mi.

Miscellaneous

Article 197.
1. $17 28.
2. $.36.
3. $17.75.
4. $4.
5. $9.52.
6. $259.20.

7. 65 yr.
8. $\begin{cases} 65\frac{35}{36} \text{ lb.} \\ 81\frac{5}{8} \text{ ''} \end{cases}$
9. $\begin{cases} 49\frac{1}{11} \text{ ''} \\ 53\frac{11}{44} \\ 66\frac{9}{11}. \end{cases}$

10. $12\frac{10}{18}$ lb.
11. $30\frac{16}{17}$ lb.
12. $22\frac{55}{57}$ lb.
13. $30\frac{78}{113}$ lb.
14. 1.96 lb.
15. 1.28 lb.

16. $\begin{cases} 28 \times 42. \\ 8. \end{cases}$
17. $\begin{cases} 32 \times 44. \\ 64. \end{cases}$
18. 9 and 10.
  No diff.

Review

Article 198.			
1. $7.68.	11. $1.44.	22. 37 hhd. 25$\frac{4}{11}$ gal.	29. $\frac{1}{4}$.
2. $7.60.	12. 5$\frac{1}{4}$c.	23. 1204 sq. ft.	30. 6$\frac{4}{9}$ rd.
3. 33.	13. 85$\frac{1}{2}$ bu. nearly.	24. 42.	31. 3 ft. 785$\frac{5}{11}$ gal.
4. 16.	14. 9 ft. +.	25. 24.	32. $8.19.
5. $122.40.	15. 34 wk.	26. $7.92.	33. $19.88.
6. 53.37\frac{1}{2}$.	16. $120.96.	27. 1 yr. 10 mo.	34. $8.75.
7. 17.	17. 100800.	19 da. 9 hr.	35. 35$\frac{1}{2}$+.
8. $\frac{7}{3}$3 31 ℈1 gr 16.	18. $13.78.	28. 29$\frac{5}{8}$ cu. ft., 60$\frac{3}{8}$	36. 90.68\frac{3}{4}$.
9. 229$\frac{23}{48}$.	19. 8.68\frac{11}{12}$.	sq. ft.	37. Gain $39.86.
10. 72.	20. $34.02.		38. 4$\frac{409}{2804}$ lb.
	21. $135.		

REDUCTION OF DENOMINATE FRACTIONS

Article 200.	13. 2 oz.	11. $\frac{7}{705}$.	9. $\frac{1}{1296}$.
2. 1 ft. 1$\frac{1}{2}$ in.	14. 1 lb. 4 oz.	12. 1$\frac{1}{7}$.	10. $\frac{1}{482}$.
3. 1 wk. 5 da. 10 hr. 40 min.	15. 6 gal. 2 qts. 3.68 gi.	13. 1$\frac{3}{80}$.	
5. 5 cwt. 30 lb. 12 oz. 12$\frac{4}{5}$ dr.		14. 2$\frac{5}{16}$.	**Article 203.**
	Article 201.	15. $\frac{27}{25600}$.	2. .7322+.
6. 8 cwt. 57 lb. 2 oz. 4$\frac{3}{4}$ dr.	2. $\frac{5}{480}$.		3. .0502+.
7. 11 A. 96 sq. rd.	3. $\frac{3}{5000}$.	**Article 202.**	4. .0034+.
8. 3 A. 77 sq. rd.	4. $\frac{3}{2120}$.	2. 1$\frac{7}{16}$.	5. .9375.
9. 7 bu.	5. $\frac{1}{13380}$.	3. $\frac{5339}{7920}$.	6. .609375.
10. 9' 54".	6. $\frac{1}{32}$.	4. $\frac{111}{224}$.	7. .6041+.
11. $\frac{7}{3}$10 ℈1 gr. 15.84.	7. $\frac{3}{80}$.	5. $\frac{1}{11700}$.	8. .000056+
12. 2 fur. 6 rd. 1 yd. 2 ft. 9$\frac{1}{2}$ in.	8. $\frac{1}{2}\frac{1}{4}$.	6. $\frac{49}{220}$.	9. .0931+.
	9. $\frac{1}{256000}$.	7. $\frac{1}{8}$.	10. .0012.
	10. $\frac{1}{230500}$.	8. $\frac{3}{8}$.	11. 5.38+.

Review Problems

Article 204.	7. $9314.80.	14. 3600.	20. £55 16s 4($\frac{4333}{4711}$)d.
1. $34.98.	8. .2844+.	15. 15 da.	21. $2310.58.
2. $8.51.	9. 600 sq. rd.	16. 86400.	22. $1554.63.
3. $20594.80.	10. 258.44.	17. $163821.	23. Liverpool. $1671.84.
4. $\frac{41}{288}$.	11. .0021175.	18. $225.30.	24. $3723.73.
5. $2.05.	12. $9782.	19. $858.08.	
6. 21 A. 111 sq. rd. 3 sq. yd. 6 sq. ft. 45$\frac{5}{9}$ sq. in.	13. .00084+.		

ADDITION OF COMPOUND NUMBERS

Article 205.	5. 26 mi. 244 rd. 5 yd. 4 in.	7. 17° 16' 37".	10. 7 fur. 18 rd. 15 ft. 6$\frac{2}{3}$ in.
2. £40 4s. 9d. 1 far.	6. 280 A. 142 sq. rd. 12 sq. yd. 6 sq. ft. 29 sq. in.	8. $116.83.	11. 6A. 113 sq. rd 21 sq. yd. 5 sq. ft. 66$\frac{2}{3}$ sq. in.
3. 14 T. 3 cwt. 24 lb. 12 oz. 3 dr.		9. 53 hhd. 40 gal. 1 qt. 1 pt.	
4. 177 bu. 1 pk. 7 qt.			

SUBTRACTION OF COMPOUND NUMBERS

Article 206.

2. 11 lb. 11 oz. 3 pwt. 15 gr.

3. 32 yr. 273 da. 10 hr. 46 min. 19 sec.

4. 57 bu. 2 qt. 1 pt.

5. 55 gal. 1 gi.

6. 2 T. 15 cwt. 94 lb. 6 oz.

7. £363 4s. 11d. 1 far.

8. 197 A. 129 sq. rd. 22 sq. yd. 7 sq. ft. 72 sq. in.

10. 2 yr. 6 mo. 21 da.

11. 7 mo. 18 da.

12. 1 rm. 16 qr. 8 sh.

13. 47° 17′ 22″.

14. 1 yr. 7 mo. 16 da. 5 hr.

15. 9 cwt. 10 lb.

16. 8 wk. 15 hr. 12 min.

17. 26 gal. 1 qt.

MULTIPLICATION OF COMPOUND NUMBERS

Article 207.

2. 41 bu. 1 pk. 6 qt. 1 pt.

3. 33 lb. 7 oz. 11 pwt. 12 gr.

4. 342 A. 114 sq. rd. 3 sq. yd. 1 sq. ft. 37 sq. in.

5. 94 gal. 3 qt. 3 gi.

6. 37 cu. yd. 8 cu. ft. 160 cu. in.

7. 99 T. 6 cwt. 94 lb. 2 oz.

DIVISION OF COMPOUND NUMBERS

Article 208.

2. 3 bu. 2 pk. 6 qt. 1 pt.

3. 1b. 1 $10 36 gr. 19$\frac{7}{8}$.

4. 38 mi. 147 rd. 3 yd. 2 ft. 5$\frac{1}{17}$ in.

5. 2 cwt. 72 lbs. 9$\frac{15}{17}$ oz.

6. 106 A. 106 sq. rd. 20 sq. yd. 1 sq. ft. 72 sq. in.

7. 5 oz. 8 pwt. 8 gr.

8. 52 bu. 3 pk. 5 qt. 1$\frac{5}{8}$ pt.

9. 5 lb. 5 oz. 14$\frac{40}{51}$ dr.

10. 10.

LONGITUDE AND TIME

Article 210.

2. 2 hr.

3. 1 hr. 6 min. 16 sec.

4. 52 min. 44 sec.

5. 37° 30′.

6. 5 hr. 8 min. 1 sec.

7. 1 hr. 19 min. 12$\frac{3}{8}$ sec.

8. 1 hr. 4 min. 44$\frac{4}{9}$ sec.

9. 2 hr. 37 min. 39$\frac{4}{15}$ sec.

10. 36 min. 28$\frac{14}{15}$ sec.

11. 2 hr. 8 min. 15$\frac{1}{5}$ sec.

12. 4 hr. 5 min. 17$\frac{1}{5}$ sec.

13. 7 hr. 38 min. 8 sec.

14. 5 hr. 34 min. 6$\frac{4}{9}$ sec.

15. 35 min. 18$\frac{2}{3}$ sec. past 11 a. m.

16. 12$\frac{11}{15}$ sec. past 3 p. m.

17. 40 min. 12 sec. past 6 p. m.

18. 33 min. 4$\frac{14}{15}$ sec. past 7 p. m.

19. 49 min. 33$\frac{3}{8}$ sec. past 7 p. m.

20. 13 min. 17$\frac{13}{18}$ sec. past 10 p. m.

21. 10 min. 19 sec. past 11 a. m.

22. 58 min. 7$\frac{1}{15}$ sec. past 4 p. m.

23. 59 min. 13 sec. past 10 a. m. 10 min. 47 sec. past 4 p. m. Saturday.

Article 211.

1. 8 min. past 4 a. m. Wednesday.

2. 52 min. past noon next day.

3. 32 min. 19$\frac{2}{15}$ sec. past 11 p. m. Monday.

4. 14 min. 56$\frac{14}{15}$ sec. past 8 a. m. next day.

5. 3 p. m. Saturday.

REVIEW PROBLEMS

Article 212.

1. 12540.

2. 553357.

3. 30.

4. $1.52.

5. $1.60.

6. 6 bu. 2 pk. 2 qt.

7. 49$\frac{4213}{5760}$.

8. $96055.31+.

9. 373\frac{1}{8}$.

10. 168.

11. 49.

12. 4 hr. 26 min. 24 sec.

13. 2 rd.

14. $\frac{1}{1680}$.

15. $\frac{68813}{180000}$.

16. 502 gal. 1 qt. 3 gi.

17. $2.58.

18. .2278+.

19. 2 lb. 7 oz. 19 pwt. 9 gr.

20. .3918+.

21. 45 rd. 3 yd. 2 ft. 9$\frac{3}{4}$ in.

22. 1 cwt. 45 lb.

23. 225 A. 127 sq. rd. 27$\frac{3}{4}$ sq. yd.

24. 203 rd. 3 yd. 1 ft. 1$\frac{5}{36}$ in.

25. 6⅛ in.
26. .04093.
27. $17.75+.
28. $37.27+.
29. $10164.

30. 44 yr. 4 mo. 12 da.
31. 1 hr. 39 min. 30 4/15 sec.
32. 9 min. 36 sec. past 6 p. m.

on the previous day.
33. July 29, 1895.
34. 20 A. 37 19/11 sq. rd.
35. 3284 99/...

36. 1418.9+bu.
37. 9+ bu.
38. 1536.01+.
39. 29 lbs 2 oz.
40. $50.97.

RATIO

Article 218.
2. 4.
3. 5/12.
4. 9 1/11.

5. 8/41.
6. 1 1/20.
7. 7/18.
8. 2 4/21.

9. 12.
10. 17.
11. 31.32.

12. 1 9/10.
13. 2.
14. 3¾.

SIMPLE PROPORTION

Article 226.
2. 1141¼.
3. $400.
4. $112½.
5. $131¼.

6. $58.80.
7. 34.
8. 19 hr.
9. 600 bu.
10. 5096.

11. $25.30.
12. 5 mo. 13 da.
13. $2.09¼.
14. 249⅔ ft.
15. 90 men.

16. 16⅔ da.
17. $17.50.
18. $2.10.
19. 8½ lbs.
20. 15.

COMPOUND PROPORTION

Article 228.
2. 8 8/15.
3. 30.
4. $18¼.
5. $9804.26.
6. $396.

7. 8 ft.
8. $1600.
9. $118⅛.
10. $512.58.
11. 5 5/12 hrs.

12. $731.25.
13. $35.64.
14. $128.
15. 4⅘.
16. 7 1/23 da.

17. $51.08.
18. 65⅛⅝.
19. 5 5/27 ft.
20. 258.
21. 36⅗⅝ da.

MEASUREMENTS USED IN BUSINESS

Article 240.
1. $270.56.
2. $31.66.
3. 1800.
4. 681¼ bd. ft.
5. $233.73
6. $760.32.

7. $1447.04.
8. $6566.40.
9. 67 6/13 perch.
10. $27.30.
11. $30.47.
12. 133½ ft, $2.27.
13. $10.66

14. 164340.
15. $1314.72.
16. 3' 7½".
17. 15 sq. ft. 128 sq. in.
18. 127440 bricks.

19. 64.5818+ perch $314.84.
20. $365.63.
21. $823.20.
22. $227.50.
23. $114.98.
24. 18300.

PERCENTAGE

Article 251.
2. $24.
3. $114.
4. $259.20.
5. $518.40.
6. $612.50.
7. 810 bu.
8. 10660 men.
9. 3981.3 ft.
10. 4042.5 lb.
11. $41.28.
12. 1674.75 bu.
13. $\frac{4}{500}$.
14. .19$\frac{7}{8}$.
15. $\frac{2}{5}$.
16. $.188$\frac{7}{8}$.
17. $3.36.
18. $688.80.
19. $1410, $4230.
20. $516.
21. $10.60.
22. 25%, $1125.
23. Jones $841.50. Brown $486.88.
24. $\frac{3}{8}$, $\frac{1}{4}$.
25. $5.30.
26. $5.40.
27. 45%.
28. 3085$\frac{7}{8}$ bu.
29. 3192.
30. 666\frac{7}{8}$.

Article 252.
1. $112.
2. 320 bu.
3. 1215 yd.
4. 238 lb.
5. 178\frac{3}{4}$.
6. 226$\frac{7}{8}$ yd.

7. 28$\frac{3}{4}$ doz.
8. $179.
9. $90.
10. 1218.
11. 14 bbl.
12. $368.

Article 253.
2. $324.
3. $5.76.
4. 182 gal.
5. 150 ft.
6. 2812$\frac{1}{2}$ yd.
7. $360.
8. $5917
9. $168.74. $105.82.
10. 767.25 bu.
11. 198 sheep.
12. $6.25.
13. $427.30 lost. $3845.70 remained.
14. $4749.50.
15. 548.
16. $18290.
17. 3637\frac{1}{2}$.
18. Wife $13500, elder son $6300, younger son $6300, daughter $18900.
19. $31229.41.
20. $301.50.

Article 254.
2. 5250.
3. 1400.
4. 2250.
5. 187$\frac{1}{2}$.

6. $2100.
7. $1800.
8. $900.
9. 400 sheep, 310 sheep left.
10. 600 yds.
11. $3600, $3888.
12. Smith $800, Brown $3000.
13. $140.40.
14. $1190.
15. Claim $3900, com. $93.60.
16. $20000.
17. $1193.75.
18. Bought 160, had 460.
19. $10, $4.50.
20. Had $2000, gave wife $150, gave daughter $62.50.

Article 255.
2. $500.
3. $300.
4. $200.
5. $500.
6. 3400 ft.
7. 3000 bu.
8. $1600.
9. 1191 lb.
10. Cost $225, selling price $267.
11. Principal $700, Interest $56.
12. 200 sheep, 10 A, 9 B, 6 C.

13. 1st year $600, 2d year $500.
14. First cost $1000.
15. Lost 18.33\frac{1}{3}$.
16. 5333\frac{1}{3}$.
17. 1600.
18. Men 54, women 24, children 9.
19. $7800.

Article 256.
2. 5%.
3. 12%.
4. 7%.
5. 25%.
6. 40%.
7. 33$\frac{1}{3}$%.
8. 12$\frac{1}{2}$%.
9. 8$\frac{1}{4}$%.
10. 25%.
11. 30%.
12. 22$\frac{1}{2}$%.
13. 20%.
14. 5%.
15. 16%.
16. 6$\frac{1}{4}$%.
17. 60%, $516.
18. 12%, 15%.
19. 40%, 35%, 25%.
20. West 28%, Packard 26%, Young 24%, Retained 22%.
21. 11$\frac{1}{4}$%.
22. 7$\frac{1}{5}$%.
23. 75%.
24. 10%.

REVIEW PROBLEMS

Article 257.
1. 66 horses.
2. $254.76.
3. $1.47.
4. $134.90.
5. $24.67.
6. $1062.
7. 1053 bu.
8. $5525.52.
9. $2.12.
10. $14.81.
11. $53.01.
12. $5504.
13. 452$\frac{1}{2}$ A.
14. $197.20.

15. $85.50, $71.25.
16. $448, 10%.
17. $500.
18. $9300, 93 shares.
19. 35% paid out, 65% remained.
20. 15%.
21. $20 loss.
22. 3900 bu. B, 2958$\frac{1}{8}$ bu. C.
23. $180, 15%.
24. $5260.39.
25. $300.
26. $89.60.

27. $6300.
28. 8$\frac{1}{4}$%.
29. $2681.87.
30. $1600.80.
31. $4269.67.
32. 15%.
33. 1062$\frac{1}{2}$ bu.
34. 25%.
35. 45% currency, 35% gold, 20% silver.
36. $2496.
37. Horse $156.52, wagon $250.44, reaper $313.04.

38. $16000.
39. $100.
40. $2000, $3000.
41. 155357\frac{1}{2}$.
42. $1920, $2880.
43. A's $691.20, B's $576, C's $720.
44. Oysters $92, fish $41.40, clams $33.35.
45. $36824.
46. 15%.

PROFIT AND LOSS

Article 264.

2. $22.20.
3. $25.20.
4. $47.60.
5. $42.53.
6. $530.
7. $417.
8. $30.
9. $59.65.
10. $6.40.
11. $460.
12. $300.
13. $180.
14. $120.
15. $11750.
16. $1600.
17. $1380.

18. $1080.08.
19. $280.
20. $440.
21. $310.63.
22. $106.
23. $3250 Hall.
    $3900 Miller.
    $4524 Davis.
24. 7500 bu.
25. $24.
26. $65.
27. $1.19.
28. $810.
29. $27, $9.
30. $203.28.
31. $502.91.

32. 25 %.
33. 8 %.
34. $16\frac{2}{3}$ %.
35. 16 %.
36. 16 %.
37. $10.
38. $11250.
39. $42.04.
40. $1499.88.
41. $27\frac{1}{2}$ %.
42. 10 %.
43. $70\frac{5}{8}$ %.
44. $35.70.
45. $537.60.
46. $1.50 gain.
47. $6.75, 6 %.

48. $38\frac{6}{8}$ %.
49. $72.
50. $2019.40.
51. $9, $6.60.
52. A $163.04.
53. $279.06.
54. $76.50.
55. $864.
56. 44 %.
57. $19\frac{9}{21}$ %.
58. $112.50.
59. 10 %.
60. $6675.
61. $3525.72.
    $3966.43.
62. 6 %.
63. $9\frac{9}{25}$ %.

MARKING GOODS

Article 267.

1. $5.76 w. t. i.
2. $\frac{n.\ bp}{n.\ ao}$
3. $\frac{m\ s}{a\ m}$
4. $\frac{y.\ oa}{y.\ ex}$
5. $\frac{o.\ rs}{o.\ ix}$

6. $\frac{i\ s}{yus.\ as}$
7. $\frac{i.\ as}{ya.\ os}$
8. $\frac{yu.\ as}{os.\ ao}$
9. $\frac{.at}{.lc}$
10. o. pn

11. $\frac{m.\ et}{a.\ mg}$
12. .eg.
13. e. he
14. $\frac{\$5.75}{\$8.05}$
15. 40 %.
16. $\frac{\$3.80}{\$0.38}$

17. $\frac{m.\ oe}{p.\ ex}$
18. $\frac{\$14}{\$17.50}$
19. o. li
20. b. ex
21. $1.04\frac{1}{6}$ c. th$\frac{1}{4}$
22. g. oe
23. r. gn$\frac{5}{8}$.

TRADE DISCOUNT

Article 275.

2. $507.
3. $15.75.
4. $27.30.
5. $156.05.
6. $15.84.

7. $5.60.
8. $2.54.
9. $259.20.
10. $35\frac{5}{7}$ %.
11. $384.75.

12. $164.15.
13. $252.67.
14. $373.93.
15. $42.34.
16. $454.48.

18. $48.
19. $25.
20. $12.
21. $8.
22. h. n r.

BILLS

Article 280.
1. $40.75.

Article 281.
2. $149.98,
   $144.04.
3. $1935.03.
   $1783.32.

4. $410.96,
   $398.63,
   $388.66.
5. $847.40,
   $805.03, $797.23.
6. $873.17,
   $804.63.

7. $36725.52,
   $34889.24.
8. $1599.30,
   $1535.33,
   $1489.27.
9. $160.52,
   $154.17.

10. $1839.63,
    $1614.28.
11. $264.04,
    $258.76,
12. $212.54.
13. $37.86,
    $37.10.

COMMISSION

Article 295.
2. $18.50.
3. $30.40.
4. $2.57.
5. $5.75.

6. $2.66.
7. $100.99.
8. $43.29.
9. $37.15.
10. $37.13.

12. $1756.30.
13. $495.85.
14. $138.46.
15. $175.68.
16. $820.52.

18. $1216.
19. $1100.
20. 870 bu.
21. $960.
22. $817.26.

23. $656.
24. 250.
25. $1055.15.
27. $400.
28. $650.
29. 100.
30. 600 bu.

31. $2.
32. $641.48.
33. $1.20.
34. $520.
35. $960.
36. 1500 bu.
38. 3 %.

39. 4 %.
40. 6 %.
41. $743.
42. $790.91,
        $869.41.
43. $1066⅔.
44. $280.

45. $390.
46. $1897.27.
47. $1033.69.
48. $319.35.
49. $144.64.
50. $2301.
51. $564.73.
        4569 + 1b.

FIRE INSURANCE

Article 311.
2. $160.
3. $24.
4. $75.
5. $639.
6. $21.
7. $93.65.
8. $3160.80.
10. $9200.

11. $3428.57¼.
        $4571.42⅗.
12. $2743.13.
13. $903.16.
14. Ætna $700,
        Home $980,
        Essex $1225,
        Phœnix $1470.

15. Mutual $621,
        Springfield $828.
        Local $920,
        Commercial
        $1242.
16. Metropolitan
        $12060, Great
        Western $14740,
        American $8710,

United States
$10050, Lancas-
ter $16750,
Orleans $6030.
17. $7200, $4698.
18. 1½ %.
19. 1⅛ %.
20. 3¾ %.

MARINE INSURANCE

Article 315.
1. $1912.50.
2. $1900.
3. $89.25.

4. $3037.50.
5. $62.18.
6. $1028.13.
7. $90.49.

8. Paoli $1659.38,
        Leipsic $2655,
        West Baden
        $3171.25, Custer

$1235.31,
Litchfield
$2489.06.

LIFE INSURANCE

Article 325.
1. $161.
2. $166.18.
3. $168.75.

4. $60.90.
5. $2036.70.
6. $96.

7. $150.30.
8. $960.25.
9. $432.50.

10. $983.50.
11. $6320.
12. $65.

REVIEW PROBLEMS IN PERCENTAGE

Article 326.
1. 11⅛ %.
2. $149¼.
3. $4⅛.
4. $3520.
5. $4.80.
6. 25⅝⁷ %.
7. $2.80.
8. 33⅛ %.
9. $20.

10. $457.14.
11. $2800.
12. $2.00 A.WX.
13. 8 %.
14. $2.80.
15. 42½ %.
16. 31⅓⅓ %.
17. First $1260,
        Second $1449.
18. $3021.74.

19. $9500.
20. $10.40.
21. 19 %.
22. $26.
23. $3640, $3328.
24. $109.20 l'wise.
        108.00 c'wise.
25. $320.
26. $200.
27. $2575.

28. 400 bu.
29. $167.75,
        18⅞⅜ %.
30. $.80.
31. $64.29 gain.
32. 56⅛ %.
33. 27₁³⁷₃₃ %.
34. $3500.
35. $4900, $5100.
36. $57.

INTEREST

Article 339.
2. $21.20.
3. $21.27.
4. $43.20.
5. $19.20.
6. $15.96.
7. $86.
8. $21.60.

9. $40.
10. $16.80.
11. $74.60.
12. $20.48.
13. $718.75.
14. $409.60.
15. $247.25.

16. $515.36.
17. $311.67.
18. $379.32.
19. $517.50.
20. $1496.24.
21. $554.70.
22. $703.73.

23. $2004.17.
24. $663.
25. $4980.
26. $360.
    Article 340.
2. $1.08.
3. $1.29.

4. $4.50.	15. $8.42.	25. $38.85.	35. $412.50.
5. $11.20.	16. $9.27.	26. $48.83.	36. $47.25.
6. $12.39.	17. $36.16.	27. $481.25.	37. $19.84.
7. $.57.	18. $32.25.	28. $2.88.	38. $33.25.
8. $1.23.	19. $23.52.	29. $1.44.	39. $43.21.
9. $1.33.	20. $94.03.	30. $6.	40. $47.
10. $1.92.	21. $36.49.	31. $1.80.	41. $147.68.
11. $1.12.	22. $417.69.	32. $81.10.	42. $3.60.
12. $31.20.	23. $107.80.	33. $73.78.	43. $30.40.
13. $3.76.	24. $43.20.	34. $1.79.	44. $13.34.
14. $11.02.			

Sixty Days Method

Article 341.	6. $2.67.	11. $11.67.	16. $.08.
2. $2.80.	7. $11.18.	12. $5.20.	17. $.32.
3. $2.65.	8. $7.08.	13. $1.73.	18. $3.72.
4. $7.20.	9. $7.	14. $2.08.	19. $.92.
5. $8.19.	10. $19.58.	15. $2.43.	20. $2.79.

Six Per Cent Method

Article 342.	7. $369.98.	13. $1297.66.	18. $758.89.
2. $37.08.	8. $46.61.	14. $865.56.	19. $1640.99.
3. $116.25.	9. $20.46.	15. $128.23.	20. $346.16.
4. $379.44.	10. $9.08.	16. $220.97.	21. $207.18.
5. $550.67.	11. $620.64.	17. $1763.72.	22. $819.58.
6. $88.05.	12. $2412.		

Cancellation Method

Article 343.	5. $17.28.	9. $57.67.	13. $1608.89.
2. $19.20.	6. $38.22.	10. $8.85.	14. $1095.75.
3. $28.	7. $96.25.	11. $4.73.	15. $2609.86.
4. $188.75.	8. $44.80.	12. $77.58.	

Common, Bankers and Exact Interest Compared

Article 344.	7. $19.68.	13. $1.46.	19. £18 8s. 1d. 3+far.
2. $28.56.	8. $2.99.	14. $5.10.	20. £32 4s. −
3. $5.70.	9. $34.46.	15. $4.33.	21. £7 11s. 6d. 2−far.
4. $.04.	10. $1.87.	16. $122.55.	22. £2 17s. 11d. 2+far.
5. $.07.	11. $.25.	17. $7.09.	23. £459 11d. 3−far.
6. $.10.	12. $.02.	18. £4 14s. 10d. 2−far.	

Problems in Interest

Article 345.	7. 2 yr. 2 mo. 12 da.	Article 346.	9. 8%.
2. 2 yr. 6 mo.		2. 8%.	10. 6%.
3. 1 yr. 2 mo. 12 da.	8. March 19, 1907.	3. 7%.	11. 10%.
4. 3 yr. 7 mo. 6 da.	9. Sept. 28, 1904.	4. 4%.	12. 8%.
5. 8 mo. 4 da.	10. Nov. 30, 1902.	5. 10%.	Article 347.
6. 27 da.	11. June 28, 1909.	6. 11%.	2. $500.
	12. May 31, 1906.	7. 9%.	3. $319.52.
		8. 8%.	4. $218.

24

5. $136.
6. $433.61.
7. $760.
8. $103.33.
9. $799.32.

10. 13%.
11. 500 bu.

Article 348.

2. $240.

3. $370.
4. $1170.
5. $180.
6. $650.
7. $550.

8. $2175.
9. $95.
10. $286.
11. $728.

Annual Interest

Article 350.

2. $915.14.
3. $428.65.

4. $1284.24.
5. $507.73.
6. $687.42.

7. $1342.37.
8. $214.92.
9. $174.88.

10. $3709.99.
11. $1395.85.

Compound Interest

Article 352.

2. $129.30.
3. $212.42.
4. $1019.86.
5. $146.08.
6. $399.65.
7. $1239.08.

8. $9.17.
9. $35.15.
10. $128.50.
11. $398.03.
12. $1091.75.
13. $10690.54.
14. $2805.86.

15. $500.
16. $5340.
17. $1000.
18. $680.
19. $460.
20. $850.

21. $1250.
22. $18.22.
23. $.44.
24. $.13.
25. $1.58.
26. $762.20.

Commercial Paper

Article 367.

1. $715.85.

2. Aug. 19, 1905.
$875.48.

3. Feb. 28, 1906,
$1279.25.

4. $883.07.
6. June 15, 1905.

Partial Payments

Article 369.

2. $262.88.
3. $728.16.
4. $719.33.
5. $393.75.
6. $212.17.

7. $2904.54.
8. $923.04.
9. $995.35.
10. $11777.
Article 370.
1. $425.50.

2. $265.44.
3. $938.42.
4. $81.60.
5. $401.47.
6. $1353.87.
7. $979.78.

8. $413.01.
9. U. S. Rule,
$.21.
10. U. S. Rule,
$1.09.
11. $559.69.

Annual Interest with Partial Payments

Article 371.

1. $6625.38.

2. $790.60.

TRUE DISCOUNT

Article 375.

2. $170.
3. $940.
4. $810.

5. $1339.94.
6. 400 bu.
7. $480.
8. $150.78.

9. $5.
10. $4.95.
11. Gain $6.73.
12. $107.52.

13. $700.
14. $103.63.
15. 900 bu.

BANK DISCOUNT

Article 379.

2. $3.30.
3. $3.70.
4. $2.80.

5. $17.39.
6. $62.63.
7. $912.33.
8. $459.30.

9. $2692.83.
10. $193.34.
11. July 12,

1905, 53 days.
$2.89, $277.11
Proceeds.

12. Feb. 25, 1906, 111 days, $21.46 bank dis., $972.79 Proceeds.
13. Oct. 1, 1905, 78 days, $17.64 bank dis., $1339.16 Proceeds.

14. June 5, 1906, 65 days, $38.03 bank dis., $2068.16 Proceeds.
15. Apr. 26, 1906, 115 days, $8 bank dis., $305.12 Proceeds.

16. $275.16 Proceeds.
17. $1814.94.
18. $1006.82.
19. $943.55
20. $608.11.
21. $720.
22. $552.92.

23. $1200.
24. $1500 Face, $1487.50 Proceeds.
25. $360.
26. $593.42.
27. $1196.64.

STOCKS AND BONDS

Article 403.
1. $378.
2. $304.
3. $270.
4. $247.50.
5. $182.25.
6. $247.
7. $207.
8. $2288.
9. $3741.10.
10. $6855.
11. $1642.20.
12. $7546.
13. $4089.
14. $1226.25.
15. $330.
16. $150.

17. $409.50.
18. $252, $3348.
19. $20846.87.
20. $408.50.
21. $513.50.
22. $1457.
23. $20830.
24. $840, 28⅜ %.
26. 27 shares.
27. $3300.
28. 41 shares.
29. $1400.
30. $9150.
31. $4315.31.
32. 200, $18650.
33. 300.
34. 86⅜.

35. 112⅝.
36. 8 %.
37. 60.
38. $19000.
39. 60.
40. 52.
41. 40.
42. 3½ %.
43. 5$\frac{5}{49}$ %.
44. 4⅓ %.
45. $262.50, 12$\frac{3}{29}$ %.
46. 5$\frac{19}{48}$ %.
47. $528, 5$\frac{81}{205}$ %.
48. Latter $\frac{4}{15}$ %.
49. $1000000 A, $750000 B, $250000 C,

1 for 1 A, 1 for 2 B, 2 for 5 C.
50. $27270.
51. $300.
52. Latter $85.50
53. $883.41.
54. $158.27.
55. $187.50.
56. $1056.25.
57. $629.67.
58. $128.50.
59. $35827.50.
60. $1059.54 Loss.
61. $80.
62. 4$\frac{244}{315}$%, 4$\frac{4}{15}$%. $12445.

DOMESTIC EXCHANGE

Article 410.
1. $560.70.
2. $728.63.
3. $1307.78.
4. $1839.49.
5. $627.75.
6. $2817.10.
7. $287.68.
8. $482.40.

9. $223.50.
10. $1875.50.
11. $930.09.
12. $589.21.
13. $864.20.
14. $326.42.
15. $1256.75.
16. $322.59.
17. $925.

18. $370.
19. $465.
20. $1178.
21. $1849.15.
22. $272.11.
23. $5772.
24. $6748.42.
25. $333.91.
26. $133.84.

27. $1229.52.
28. 1500 bu.
29. $510.64.
30. $599.69.
31. $947.91.
32. $433.22.
33. $109.23.
34. $1801.80.
35. 20 shares.

FOREIGN EXCHANGE

Article 415.
1. $4332.08.
2. $780.
3. $660.34.
4. $1546.05.
5. $375.

6. $492.83.
7. $5918.86.
8. $782.78.
9. 2200 bu.
10. $1320.

11. $840.32.
12. $80.
13. £583 12s. 6d.
14. 4193.98 fr.
15. 660 marks.

16. £710.
17. 8000 marks.
18. £526 4s. 2d.
19. $32, 1905.32 fr.
20. 1021.27+ yd.

NATIONAL BANKS

Article 422.
1. $62500, $62500.
2. 5 persons,

$50000, $12500 to $50000
3. $480000, $24000.
4. 31¼ %, $156.25.

5. $212565.
6. $2235, $2115.
7. $21250, $425000.

8. $643.25.
9. $3265, $11885.
10. $51400, $55897.50.

SAVINGS BANKS

Article 425.
1. $2.35.
2. $30.02.
3. $992.94.
4. $1003.27.
6. $352.92.
7. $787.64.
8. $1973.90.
9. $755.15.
10. $1910.63.
11. $243.90.
12. $493.69.
13. $135.17.

TAXES

Article 432.
1. $421.70.
2. $81.08.
3. $5836.50.
4. $12164.04.
5. $467.10.
6. $1972.92.
7. $1466.85.
9. $184.97.
10. $329.87.
11. .018.
     .09.

CUSTOMS OR DUTIES

Article 448.
1. $255.60.
2. $590.27.
3. $877.80.
4. $318.36.
5. 2641.79.
6. $209.91.
7. $222.61.
8. $488.87.
9. $3754.25.
10. $1897.54.
11. $2770.86.
12. $2197.80.
13. 24782.66.

EQUATION OF ACCOUNTS

Article 456.
2. April 10, 1905.
3. 5 mo. 21 da.
4. 9 mo. 12 da.
5. Oct. 16, 1903.
6. Aug. 9, 1905.
7. Oct. 15, 1905.
8. Oct. 2, 1905.
9. June 23, 1905.
10. Oct. 6.
11. May 8, 1905.
12. Aug. 20, 1905.
13. June 14, 1905.
14. March 14, 1906.
15. June 29, 1905.
16. May 13, 1905.
17. Oct. 28, 1905.
18. July 1, 1905.

Article 457.
2. April 27, 1905.
3. April 2, 1905.
4. May 28, 1905.
5. Jan. 28, 1906.
6. Jan. 2, 1905.
7. Oct. 21, 1905.
8. July 30, 1905.
9. Oct. 16, 1905.
10. April 1, 1904.
11. $808.96.
12. $595.48.

Article 458.
1. Aug. 21, 1905.
2. June 19, 1905.
3. June 17, 1906, $19.83.
4. April 19, 1905, $499.69.

CASH BALANCE

Article 459.
2. $1188.63.
3. $1311.41.
4. $724.03.

PARTNERSHIP

Article 472.
1. 2001.
2. $1042.50.
3. $877.
4. $2906.28.
5. Gain $2552.33
   A $1160.15,
   B $928.12,
   C $464.06.
6. Gain $4835.36,
   share of each
   $1208.84.

Article 473.
2. C $19099.60,
   D $18849.60,
   E $18699.60.

3. Jones $4552.40,
   Brown $3602.40,
   Smith $3096.20.
4. F $6308.08,
   G $7067.07,
   H $6838.77,
   I $6184.38.
5. O $4325,
   P $4342,
   Q $4505,
   R $4371.

Article 474.
2. Parker $4105.65,

Hammond $3844.65,
Siders $3593.75,
Firm $11544.05.
3. Stewart $4593.16,
   Nevins $4543.66,
   Barnard $3193.43,
   Firm $12330.25.
4. A $2398.58,
   B $3239.37,

C $2935.88,
D $3114.44,
Firm $11688.27.

Article 475.
2. Gain $920.35,
   A $406.22,
   B $514.13.
3. Gain $825,
   Fuller $225,
   Irwin $330,
   Diers $270.
4. A $792,
   B $561,
   C $957.

5. Jennings $1200,
   Fuller $792,
   Clark $948.
6. Gain $1009.80,
   F $299.20,
   G $336.60,
   H $374.
   Article 476.
2. Hammond $1030,
   Cowles $960.
3. Manning $1480.11,
   Miller $2394.20,

Collins $1626.49.
4. Tyler $310.40,
   Brady $422.96,
   Hess $511.64.
5. 20.0568 %,
   A $932.64,
   B $656.86,
6. A $707.69,
   B $675.85,
   C $556.46.
   Article 477.
2. W $9353.11,
   G $10470.11,
   S $14142.78.
3. A's cr. int.

$320,
B's cr. int. $501,
C's cr. int. $649,
D's cr. int. $876.25,
A's cap. $296.96,
B's cap. $1066.44,
C's cap. $802.91,
D's cap. $5701.69.
4. Harding

$3277.89,
Wilson $5394.93,
Farrel $5038.83.
5. A $5668.58,
   B $6331.42.
6. Loss $975.10,
   A $4743.69,
   B $4716.55,
   C $8284.66.
7. White $1848.86,
   Murray $2651.14.

INVOLUTION

Article 482.
1. 324.
2. 157464.
3. 19.0096.
4. 31640625.
5. 1.97382+.
6. 23.6196.
7. 1024.

8. .027.
9. $\frac{343}{729}$.
10. 1.21665+.
11. 1.340095+.
12. $\frac{6561}{390625}$.
13. $23\frac{13}{24}$.
14. 7776.
15. $30\frac{1}{4}$.

16. $\frac{1}{8}$.
17. 11529.
18. 3888.
19. 47^{14}.
20. 113A 145 sq. rd.
21. .000000000001.
22. .00000081.

23. 1.27628.
24. .000000001.
25. .00001936.
26. 16 yd.
27. 421875 cu. in.
28. 19.19140625.
29. $\frac{533443}{7608125}$.

SQUARE ROOT

Article 489.
2. 32.
3. 43.
4. 65.
5. 248.

6. 667.
7. 625.
8. 1296.
9. $\frac{7}{25}$.
10. $5\frac{1}{4}$.

11. $1\frac{1}{8}$.
12. $16\frac{7}{8}$.
13. .866+.
14. 1.732+.
15. .8164+.

16. 4.168+.
17. .094.
18. .0081.
19. 1.732+.
20. 11.180.

Applications of Square Root

Article 496.
1. 50 ft.
2. 12.64+ ft.
3. 51.26+ in.

4. 146.86+ ft.
5. 21 ft. 11 in.
6. 80 rod, 320 rod.

7. Width 53.15+ ft., length 106.30+ ft.
8. 49.92+ ft.

9. 452.54+ rd.
10. 187.46+ rd.
11. 40.85+ ft.

CUBE ROOT

Article 497.
2. 36.
3. 63.
4. 126.
5. 177.

6. 216.
7. 359.
8. 441.
9. 536.
10. 630.

11. 9.75.
12. 3.54+.
13. 1.
14. 1.25+.

15. 1.44+.
16. 2.08+.
17. 2.35+.
18. $\frac{3}{4}$.

Applications of Cube Root

Article 497.
1. 39 in.
2. 14.32 ft.
3. 57 ft.

4. 999 in.
5. Depth 55.6+ in., length 111.2+ in.

6. 12 ft. 10.8+ in.
7. 3 ft. 8+ in.
8. 12150 sq. ft.

9. 8 ft. 6+ in.
10. 7 ft. 6.9+ in.
11. 8 ft. 8+ in.

MENSURATION

Article 511.
1. $200.
2. $6503.91.
3. 576.
4. $32.36.
5. $39\frac{1}{12}$ yd.
Article 514.
1. 486 sq. yd.
2. $672\frac{3}{4}$ sq. ft.
3. 800 sq. ft.
4. $54.
Article 519.
1. 9243.7 ft.
2. 376.99+ rd.

3. 203.71+ rd.
4. 235.62 ft.
5. 3 ft.
Article 520.
1. 1017.87+ ft.
2. 10.456+A.
3. 1A 20+ sq. rd.
4. $1963\frac{1}{2}$ sq. yd.
5. $4417\frac{7}{8}$ sq. ft.
Article 531.
1. 6 sq. ft. 108 sq. in.
2. 36 sq. ft.

Article 532.
1. 198 sq. ft.
2. $373\frac{1}{2}$ sq. ft.
3. 27.0963 sq. ft.
4. 600 sq. ft.
Article 533.
1. 425 cu. ft.
2. 4230.144 gal.
3. $5026\frac{10}{11}$ gal.
Article 534.
1. 1728 cu. ft.
2. 32616 cu. ft.
3. $6946\frac{35}{68}$ cu. ft.

4. $1435456\frac{64}{81}$ cu. yds.
Article 538.
1. 3631.6896 sq. ft.
2. $45.24.
3. 196663355.7504 sq. mi.
Article 539.
1. 1767.15 cu. in.
2. 14137.20 cu. ft.
3. 2982.0656+ cu. ft.
4. 354.08+ hhd.

METRIC SYSTEM

Article 543.
1. 763.217 km.
2. 318462 m.
3. 39,516,000 cm.
4. 516.26 m. .51626 km.
5. 106.25427 miles.
6. $168.75.
7. 1577.114 km. 1.771.14 hm.
8. 16.9164 m.

9. 6.35 m.
10. 197.63 dm. 1976.3 cm.
11. 56.38 a. .5638 ha.
12. 2187500 sq. m. 2187500 ca.
13. 286.176 ha.
14. $12.83.
15. 5.106383 − km.

16. 100 ha.
17. .015004008 cu. m.
18. 14018.0036 cu. dm.
19. 10001.
20. $.066.
21. $18205.92.
22. 6703.125 Dl. 67.03125 cu. m.

23. 3.645 l.
24. 1000 g.
25. 907.2 kg.
26. 11.023 lb.
27. 2204.6 lb.
28. 91000.
29. $2\frac{1}{4}$ s.
30. 3 cu. m.
31. 46.328 cu. m.
32. 6840 sq. m.